DOCUMENT RESUME

ED 029 948 VT 006 382

By-Hollister, Robinson

A Technical Evaluation of the First Stage of the Mediterranean Regional Project.

Organisation for Economic Cooperation and Development, Paris (France).

Pub Date 67

Note-178p.

Available from-OECD Publication Center, Suite 1305, 1750 Pennsylvania Avenue, Washington, D.C. 20006 ($2.50)

EDRS Price MF-$0.75 HC-$9.00

Descriptors-Comparative Analysis, *Educational Needs, Educational Planning, Employment Potential, Employment Projections, *Evaluation Techniques, Foreign Countries, *Manpower Needs, Occupational Clusters, *Occupational Information, Occupational Surveys, Research Design, *Research Methodology, Vocational Education

Identifiers-Mediterranean Regional Project, MRP

Objectives of this technical evaluation concerning the transfer of experience in the development of human resources were to develop educational plans based upon comprehensive estimates of manpower requirements and to evaluate the methods used in estimating manpower requirements for educational planning. The methodology involved estimates of the total output of the economy, sectorial output, inverse sectorial labor productivity, total occupational distribution, education associated with the occupation, total educational stock, increment of manpower by education, and the total graduate flow. Some findings were: (1) The impact of manpower requirements upon the educational system is likely to be very significant. (2) Uncertainty about productivity change is largely transformed into uncertainty about the occupational structure. (3) Substitution possibilities exist and can be important in their effects on manpower requirements estimates. (4) Improved efficiency was not obtained by disaggregation of data used in manpower requirements estimation, and (5) There is little knowledge about the education associated with each occupation. Tables of data and descriptions of the methodology employed are appended. (DM)

ED029948

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A TECHNICAL EVALUATION OF THE FIRST STAGE OF THE MEDITERRANEAN REGIONAL PROJECT

by

Robinson Hollister
Consultant to the OECD

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT
Paris 1967

The Organisation for Economic Co-operation and Development was set up under a Convention signed in Paris on 14th December 1960 by the Member countries of the Organisation for European Economic Co-operation and by Canada and the United States. This Convention provides that the OECD shall promote policies designed:

- *to achieve the highest sustainable economic growth and employment and a rising standard of living in Member countries, while maintaining financial stability, and thus to contribute to the development of the world economy;*
- *to contribute to sound economic expansion in Member as well as non-member countries in the process of economic development;*
- *to contribute to the expansion of world trade on a multilateral, non-discriminatory basis in accordance with international obligations.*

The Members of OECD are Austria, Belgium, Canada, Denmark, France, the Federal Republic of Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States.

The Directorate for Scientific Affairs, which is responsible for the publication of the present report, has been established within OECD to take charge of the activities of the Organisation relating to science policy and research and to the expansion and rational utilisation of the scientific and technical personnel available so as to meet the needs arising from economic growth.

The Mediterranean Regional Project consisted of a joint programme undertaken by countries in Southern Europe (Greece, Italy, Portugal, Spain, Turkey and Yugoslavia) to prepare for governments an assessment of their educational needs up to 1975 and to arrive at detailed plans, including financial estimates, for meeting these needs. The Project was initiated by bilateral agreements between the OECD and the participating countries. The expenditure involved is shared.

The OECD Secretariat's share of the work consisted of research in co-operation with national teams of experts, consultation, the training of research workers and the preparation and publication of methodological documents and national reports.

A grant from the Ford Foundation has made it possible to apply to other developing countries the experience acquired in the planning of human resources. The technical evaluation of the methods and results of the Mediterranean Regional Project was carried out under this programme and forms the subject of this publication.

OECD's Development Centre, which co-operated with the Directorate for Scientific Affairs in the carrying out of this programme, was set up in 1962. Its task is to assemble the available knowledge and experience of participating countries concerning both economic development and the drawing up and carrying out of general economic policies, to adapt this knowledge and experience to the actual needs of developing countries or regions and, by the appropriate means, make it available to the countries concerned.

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PREFACE

The present volume is the first of a series dealing with a number of studies carried out under an OECD programme financed by the Ford Foundation. This made it possible to undertake several projects concerning the transfer of experience in the development of human resources and particularly by investigating conditions as they more specifically apply to non-Member countries. The five studies which will make up the series are:

1. A Technical Evaluation of the First Stage of the Mediterranean Project.
2. Human Resources, Education and Economic Development in Peru. Forecasts of manpower requirements in 1980 and of educational development prospects.
3. Education, Human Resources and Development in Argentina.
4. Problems of Human Resources Planning in Latin America and in the Mediterranean Regional Project Countries.
5. Problems of Educational and Manpower Planning in the Arab Countries and Mediterranean Regional Project Countries.

These five publications report the results of the main operations conducted under this programme designed to transfer experience. The present work constitutes a stage of critical appraisal anticipating the more concrete study of methods and the manner of their application to non-Member countries. The next two describe pilot experiments conducted in Argentina and Peru along much the same lines as during the initial phase of the Mediterranean Regional Project.

The last two publications confront the findings of experts from Latin American and Arab countries with results obtained by the MRP or by other OECD countries, as analysed at two regional seminars also sponsored by the programme.

These five publications clearly show that the Programme was more than a simple transfer of experience; in both Argentine and Peru the work of the OECD experts was not simply to apply, as such, the same forecasting methods as had been worked out and applied during the first phase of the MRP for estimating manpower and educational planning requirements. First, the work was carried out in close co-operation with the national experts of the planning services of the two countries, thus facilitating adaptation to the specific conditions each country; secondly, the first stage of the programme, which is the subject of this volume, consisted of a critical evaluation of the methods and results of the MRP forecasts. Included in the conclusions are a number of improvements to the methods used for analysing the labour market and forecasting techniques. Quite a few of them have been applied in Peru and Argentina, particularly the multi-dimensional analysis of the population census, allowing much better use to be made of the available information on manpower. In addition, the qualitative analysis of the educational system went more deeply than in the MRP, and OECD's recent work on the application of mathematical models to the study of educational output was first tried out in Argentina.

The publication of this series will allow the results of the experiment to be made available to other Member and non-Member countries; this is not just a description of what has been done, but a careful examination of the methodological problems which crop up when the aims of educational development are being brought into line with those of economic development. Case studies, and the regional confrontations which are the subject of each of these studies, extend the geographical field of the application of the planning of human resources, at the same time as they propose techniques for analysis and forecasting.

This does not mean that these experiments are given as models to be copied. Although this programme is now finished, it consisted of no more than one stage; much still remains to be done for the stop from long-term forecasts to operational plans and their execution, and forecasting methods, which still leave much to be desired, must be improved. The publication of the results is thus in this sense an invitation to all specialists to offer their criticisms - a condition of future progress.

Thorkil Kristensen
Secretary General of the OECD

FOREWORD

The Mediterranean Regional Project (MRP) was initiated, under the auspices of the OECD Committee for Scientific and Technical Personnel, by bilateral agreements between the Organisation and the Governments of Greece, Italy, Portugal, Spain, Turkey and Yugoslavia. It represents a major and original attempt by these countries to assess the implications of economic and social objectives on the size and distribution of requirements for education in the period up to 1975.

This project has now been completed and the six national reports have been published together with related methodological studies resulting from the experience gained during the course of its implementation. A Special Review of the whole experiment and its implications for the educational development policies of the six countries concerned has also recently been carried out by the Committee for Scientific and Technical Personnel.

Although based on the same methodological principles - which was the actual aim of the Programme - the experiments made in the six MRP countries gave different results, owing to the social and economic structure of the countries and the resources available. It was therefore necessary in a retrospective study on the one hand to assess the extent and significance of these differences and on the other, and especially, to see how far the method of approach was applicable to the national planning of human resources.

The technical assessment which will be found in the present volume has been undertaken for this purpose in the context of a programme carried out thanks to a grant from the Ford Foundation. Although the MRP method is not simply based on economic factors and takes general account of the social objectives of education, this assessment has been intentionally confined to the problems raised by forecasts of manpower requirements and their incidence on estimates of educational requirements.

However, R. Hollister has not merely assessed the method of forecasting manpower requirements used in the MRP countries. He has examined the very principles of the approach in the light of the criticisms levelled against it. In particular, he has provided practical evidence on the basis of data taken from the six national reports, for or against arguments which have so far most often remained theoretical. Lastly, he has suggested methods for identifying the essential factors in the chain of operations which lead to the final forecasts, emphazising the most delicate problems - which are also the least well-known - that arise at each stage of the process.

Much of course remains to be done in order to refine and perfect the methods of projection, but R. Hollister suggests - and this is not his smallest merit - lines of research which should prove fruitful. From this angle, the technical assessment provides a methodological contribution of very high interest; but what is still more important, it demonstrates that the manpower requirements approach is both rational and applicable to educational planning.

Alexander King
Director for Scientific Affairs

INTRODUCTION

The present publication is an extension of the Mediterranean Regional Project (or MRP), which, it will be recalled, was initiated and developed under the auspices of the Committee for Scientific and Technical Personnel as a joint undertaking by six countries (Greece, Italy, Portugal, Spain, Turkey and Yugoslavia). Its purpose was to forecast long-term manpower needs according to a common methodology and draw the necessary inferences in regard to training and education.* To succeed in such an objective, the OECD Secretariat first prepared a systematic set of working assumptions and forecasting methods linking long-term economic development prospects with educational targets. The six country reports are not mere exercises in the practical application of these methods - these were adjusted and amended in the light of the available data, the conditions obtaining in each country, and the choices decided upon by each work team.

Hence it was not a matter of suggesting that the non-Member countries ape the experience of the MRP and apply ready-made methods, but rather that they should make use of the earlier findings by taking the positive results into account as well as any aspects which called for improvement. For this reason it was thought expedient that such a transfer of experience should begin with a critical appraisal of the MRP's methods and statistical projections, consisting in an analysis of the theory on which the forecasting methods were based and an empirical examination of manpower and educational changes as foreseen by the various countries in 1975.

The theoretical part of the study contains a detailed analysis of objections often made to the methodology used in forecasting manpower requirements, particularly the validity of the simplifying assumptions underlying such forecasts : on the premise that a given productivity level can be attained only through a single combination of occupations, each requiring a specific type of education, it would then be possible to proceed from the economic objectives to the educational objectives, provided the statistics required were available. But it is neither likely nor, incidentally, desirable, that such a degree of rigidity should exist between production, the occupational structure and levels of education. An analysis of the comparative statistics obtainable indicate that substitution possibilities between occupations and between types of education for a same productivity level are considerable, even without allowing for various feasible combinations of the capital and labour factors.

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* The Mediterranean Regional Project: Country Reports: Greece, Italy, Portugal, Spain, Turkey and Yugoslavia, OECD, Paris, 1965 (6 vol.). See also: Herbert S. Parnes, Forecasting Educational Needs for Economic and Social Development, Paris 1962. Planning Education for Economic and Social Development, OECD, Paris, 1962.

This stresses the value of undertaking research on the rational use of labour so as to develop present methods of manpower planning, which are chiefly based on fixed complementary relationships observed in the past or in foreign countries. One of the things made possible by the MRP Technical Evaluation is research into the methods of combining the levels and types of training most effective with the various occupational categories; this moreover is linked to the search for a criterion of optimum yield from educational expenditure.

In the empirical section of the technical evaluation, changes in the occupational structure of the active population as estimated in the MRP reports from 1960 to 1975 are analysed, an attempt being made to assign a weight to each of the factors considered by the planners; according to the results yielded by such an analysis, the assumptions as to overall growth rate and labour productivity in each economic sector appear to have the greatest impact on occupational structure estimates, whereas changes in the economic structure (i.e. distribution of the National Product among the various branches) and in the occupational pattern within each sector have affected results to a less extent; such provisional conclusions, which are largely confirmed by an analysis of the changes observed in Italy's occupational structure between 1951 and 1961, suggest that manpower planners should pay special attention to the factors which have the most marked influence on the result of their estimates, and that, as necessary, they should formulate variants for these preponderant factors.

At another stage of the analysis, an attempt was made to determine the factors of change in the educational stock of the labour force, one of the most important, yet least known, phases in forecasting educational requirements. The findings obtained by using the same method as in the previous analysis seem to indicate that the trend in training requirements between 1960 and 1975 will hinge on the raising of the level of education in each occupational category of the labour force. This underlines the importance of correctly formulating assumptions as to the future level of training considered desirable in each occupation, as well as the need for data on levels and types of education corresponding to the occupations.

The publication of this critical analysis of the MRP and the accompanying international comparisons may offer other countries an insight into methods and criteria of thought.

As an annex to this Secretariat study, conducted under the supervision of Robinson Hollister, Consultant to the OECD, two notes were prepared by Raul Trajtenberg, a Uruguayan economist, in conjunction with his secondment to the OECD under the Ford Foundation programme. These discuss a number of theoretical and practical problems which arise when the method is used to analyse structural changes occurring between two censuses. Particular findings selected for comment are those resulting from a numerical application to changes in the education structure of the labour force in Japan from 1950 to 1960, the purpose being to determine the respective weights of an increase in the total labour force, changes in the economic structure, and levels of education in each occupational category.

The method can also be more generally applied to all factors which show a significant change, such as the age structure, rate of activity, etc. Other methods are finally suggested for measuring changes which are applicable to such nonsequential variables, as occupational categories or various types of education.

⁂

Two works in the same series compare the MRP experiment with (a) that in Latin America and (b) that in the Arab countries. A seminar of experts from seven Latin-American states and various OECD countries was held in Lima in 1965, before the pilot schemes were started in Argentine and Peru. This comparison of methods and results was not limited to discovering similarities and differences between the problems in the two regions; it also gave rise to a considerable amount of thought on methods for planning human resources in the MRP. Two Latin-American experts made a critical analysis of the MRP reports on Greece and Spain, taking into account Argentine and Peruvian experience. The working documents and the reports on the seminar were subsequently completed by a comprehensive report, and by a study on the manpower structure in Latin America and its trend during the past ten years.

An OECD Seminar held in Beyrouth and attended by experts from the Arab countries also formed the basis for a report consisting of: the working documents, an account of the meeting, statistical and methodological studies on techniques for forecasting manpower needs, and on the structure of the active population of the Arab countries and educational expansion in this area.

⁂

Two other works describe pilot experiments conducted in Peru and Argentina under the same programme, they are comparable in many respects to the MRP national reports referred to above, for the levels of economic and educational development are as different as are those in Turkey and Spain. OECD has worked in both these countries with the national authorities on a co-operative programme to supplement economic and educational planning by manpower forecasts, so that long-term training needs might be determined. Experts sent by the OECD in 1965 and 1966 worked in the education and human resources sections set up by the central planning agencies (the National Planning Institute in Peru and CONADE in Argentina). Five experts (of which four had previously helped in the MRP) were assigned to these two projects throughout the period required to prepare the reports. These operations also included several brief missions and specialized training for Latin American planners, who were associated either with the teams' local activities or with similar studies conducted at OECD.

Complete versions of the reports describing the results of both pilot experiments have been published by the authorities of the countries concerned; as part of the series to which the present publication belongs, OECD is to issue a slightly shorter version of each, which will discuss methodological aspects of value for other countries. As in the MRP reports, the forecasts of manpower requirements are long-term (15 years) and are linked to the country's economic growth prospects and the relevant educational needs. The methodology follows the pattern applied in the MRP, but an effort has been made to profit from the lessons taught by earlier experience, special attention being paid to the analysis of the labour market. In both countries use was made of the 1960 census figures, to compute electronically a cross-classification of the active population.

This series is being published to allow the public access to the results obtained from this exchange of experience and which are of general methodological interest. The countries concerned, rather than OECD, must be the ones to decide just how valuable the project has proved. But the considerable benefit of the exchange to the OECD should be mentioned. It is precisely the element of reciprocity - a most significant feature of the programme - which warrants an initial evaluation of the results.

1. Favourable working conditions were encountered in both Peru and Argentina. As in the Mediterranean Regional Project, the undertaking received the sponsorship and support of the government authorities; the presence of the work teams at the Peruvian National Planning Institute and in the Argentinian National Development Council enabled close contacts to be established with the groups responsible for economic planning; the technical capacities of the national work teams also constituted an essential factor.

2. The methodological significance of the work accomplished deserves to be mentioned, as it was possible to continue and develop the experience gained in the Mediterranean Regional Project. A systematic analysis was made of the labour force by occupational categories, economic sectors and levels of education, as well as by sex and age groups. This multidimensional classification was processed by computers, use being made of highly representative samples (respectively one-tenth and one-fifth) of the 1961 Peruvian census and the 1960 Argentinian census. A better base was thus obtained for manpower forecasting purposes and allowed projections to be made of labour-market entries during the 1960-1980 time span, as distinguished from workers already on the market, whose educational level is already fixed.

Use was also made of international comparisons of the quality structure of manpower, based on the latest relevant OECD figures. Methods for the quantitative and qualitative analysis of educational systems were also refined, by evaluating educational outputs and recent trends by means of graphs for Peru, and of mathematical models for Argentina. In the latter country these models were used to project past trends in order to assess the long-term impact on the labour market (based on three different educational output assumptions); it was then possible for such an extrapolated "supply" of educated workers to be set against the projected economic demand expressed in terms of manpower requirements.

5. An interesting exercise would be to see to what extent the Argentinian analysis can be considered as an advance on the country studies of the Mediterranean Regional Project. The most salient and significant points appear to be as follows:

- In the Argentinian report, the aspect most heavily stressed is the internal effectiveness of the educational system and the problem of dropouts and repeaters was thoroughly examined. A model was constructed enabling the highly important question of educational yields to be thoroughly analysed.
- The report contains not only a projection of economic and manpower needs, showing their impact on the educational system, but another type of forecast designated as a "supply projection". This consists of a self-contained educational sector projection based on previous graduate, dropout and repeater trends. Two separate educational structures were accordingly devised: one "imposed" by economic development, and the other stemming from a quasi-spontaneous growth of the educational system as determined by observed trends, and which sometimes has perhaps improperly been described as the projection of "social demand".
- The authors of the report have moreover undertaken a detailed analysis of the occupational and educational structure of the labour force in 1960, using the 20% census sample taken for the express purpose of this study. This provided a valuable picture of the labour force as now distributed among the various economic sectors, by occupation and type of education.
- Generally a range of values rather than single values are supplied by the projections, which thus follow the suggestion in the Technical Evaluation of the MRP in regard to the usefulness of sensitivity analysis.

4. Among the results yielded by the forecasts, some should at least briefly be mentioned. The Peruvian report, for example, states that the labour market will not evolve simply by substituting an outgoing generation by an incoming generation; for two-thirds of the new graduates fresh jobs will have to be created, since only one-third will be required for replacement purposes. This phenomenon, which is due to the extremely high rate of population growth (over 3%), will make it difficult to conciliate a policy of full employment with the need to increase productivity in the different branches of the economy. The report accordingly suggests that special attention be paid to civil engineering projects, which are mainly financed by the Government so that employment could be influenced by maintaining a high rate of growth and through the systematic use of labour-intensive techniques.

5. Gaps of course exist in the reports, partly due to the shortage of statistical data, and partly because the time needed to complete and revise certain portions of the work was lacking.

In the Peruvian report, it is thus unfortunate that labour and production in the traditional sector could not have received separate treatment: the usual occupational classification is hardly applicable and is troublesome in the interpreting of census date, whether in the industrial and service branches or the agricultural sector; implicit in the projections is the same sort of treatment for subsistance production and labour as for the modern sector. An analysis in depth of the labour market would moreover have been desirable for a better appraisal of just how effectively the available manpower was being used, whereas recourse could be made only to the 1961 population census figures and the 1963 industrial census; as a result, the distribution of industrial workers among the three categories; skilled, semi-skilled and unskilled manpower, which was essentially needed to determine training requirements, was evaluated from statements by the parties concerned and their interpretation by the services examining the questionnaires, and not on the basis of objective criteria. Forecasts of labour productivity are moreover based on the growth rates regarded as both desirable and compatible with the experience of other countries, but still conducive to full employment; but no information concerning the latest trends of sector productivity, technical progress, business engineering methods, scale economies, etc., nor data for assessing the prospects for each branch, or concerning the factors likely to influence it were available. Lastly, the ultimate balance between education, manpower and the economy in 1980 might be criticised as unduly optimistic were such an achievement to be interpreted as a forecast, instead of in its proper context, which is to suggest action needed to channel the current trend in the right direction. One might say, in summing up the conclusions of the Peruvian report that even if the exceptionally fast growth of the economy in recent years is sustained during the next fifteen, quantitative and qualitative manpower needs would be served by an educational system expanding at a much slower rate than at present - this reduced rate of growth would in any event be bound to occur shortly due to unavoidable financial obstacles, the present effort having attained the maximum possible in view of the other needs of the economy. It will thus be seen that in dealing with human resources, the policy problems consist in selecting alternatives and taking action, rather than in endlessly arguing about the number of pupils and educational establishments. The report should not therefore be considered as a passive forecast doing no more than prolonging a spontaneous development but as a working instrument, an overall study to be used as a basis for taking decisions which would change the educational system.

Methodological improvements and the value of the results forcast are not the only criteria for appraisal, however. Long-term forecasts are not an end in themselves; regardless of their interest, confrontations of experience such as those attended by experts from the Latin American and Arab countries will not have proved worthwhile unless they succeed in furthering the subsequent progress of projects undertaken in each of the countries concerned. Nor were the co-operative activities during the Peruvian and Argentinian pilot experiments conducted for the sole purpose of preparing and publishing the final reports. This fact is particularly important since the long-term forecats must in no event be regarded as plans which need merely to be applied. The reports attempt to determine the long-range consequences of economic growth prospects in terms of manpower requirements and training needs by using a set of perhaps arguable but invariably clearly reasoned assumptions, based on a critical inventory of all the information available. Their purpose is to define the conditions which would enable the objectives of economic expansion and development of the educational system to come into balance by about 1980. Hence these are not medium-term operational plans, and still less are they specific programmes for measures to be taken or schools to be built. As indispensable adjuncts for evaluating the remoter consequences of decisions which will require immediate outlays but will have no impact on the economy for over a decade, such basic studies can be of help in preparing the actual plans and in choosing the main alternatives.

Generally speaking, the two reports offer a set of facts, food for thought and criteria which can serve as a basis in formulating a systematic education policy, whether in the short, medium or long term. Their value will therefore depend on how they are used, both in referring the reports for attention and study to the various administrative departments, and in submitting them for examination and discussion by the agencies and individuals concerned. This phase of participation and debate should enable priorities to be determined, thus enabling concrete measures and choices to be decided upon, the next step would consist in carrying out the decisions and in devising a scheme for continuous evaluation, so that results can regularly be compared with predictions and any needed adjustments or revisions be made.

The success of such a programme for transferring experience cannot therefore be assessed in terms of a single, simple criterion or of the results directly achieved. In any case, at leats one of the objectives of the programme will have been attained if, from now on, the work thus undertaken influences planning methods by maintaining the contact established between the plans of the economic sectors and those of education; if it has the effect of stimulating new education and manpower research using, completing and improving the material contained in the reports, and especially if it is used by the various administrative departments concerned i.e. the Ministries of Education and Labour; by helping to strengthen the co-ordination necessary between planning and execution, between those who prepare the projects and those whose duty it is to carry them out.

Michel Debeauvais
Advisor,
Directorate for Scientific Affairs

First Part

A TECHNICAL EVALUATION OF THE FIRST STAGE OF THE MEDITERRANEAN REGIONAL PROJECT

This study was carried out under the Ford Foundation Grant to the OECD for studies in human resource economics. I wish to thank J.R. Gass, Necat Erder and Louis Emmerij for their patient guidance of this work from start to finish. Mrs. Eva Ryten contributed substantially to both the conception and content of the analysis. R.M. Lyman, R.F. Lyons, H.S. Parnes, R. Trajtenberg, and G. Winston all were kind enough to read a draft of the document and provide valuable suggestions for improvements. Above all, I am deeply indebted to the Directors and members of the Mediterranean Regional Project National Teams, whose original work provided the basic materials for this study.

Robinson Hollister

I

THE RANGE AND OBJECTIVES OF THE STUDY

A. The Range of the Study

1. This study is devoted to a very specific set of issues: those concerning the methods of estimating manpower requirements and the derivation of educational requirements from these estimates. Other aspects of the first stage of the Mediterranean Regional Project are evaluated in two other documents. In "An Experiment in Planning by Six Countries"[1], a statement of the scope of the project and a summary of some of the quantitative features of the plans which emerged from the first stage of the MRP are presented and, in addition, some of the policy implications are drawn. The financial aspects of the first stage are examined in a paper on the "Financial Implications of the MRP Targets"[2]. The three documents combined - this study, "An Experiment" and "Financial Implications" - provide a fairly complete evaluation of the first stage of the MRP.

2. The range of this study is limited not only because it does not attempt to cover fully the MRP experience to date but also because, in general, it does not attempt a comprehensive comparison of the manpower requirements approach to educational planning, which underlies the MRP, with other approaches to educational planning[3]. However, in the final chapter, entitled "A Perspective on Educational Planning and the Manpower Requirements Approach", some views are presented on the controversy about various approaches to educational planning. The focus of the study was purposely concentrated on the problems of linking the targets of economic growth to educational requirements because this aspect of the MRP approach provides it with particular characteristics as a tool for educational planning. As the length of this study testifies, even this smaller field provides ample challenge for analysis.

3. For introductory purposes, it is helpful to indicate the nature of the problems the MRP had to face and the philosophy of the approach adopted. As an excellent statement of this type was presented in An Experiment, it is quoted at length here:

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[1] OECD 1965.

[2] OECD 1965 mimeo.

[3] For these purposes see W.G. Bowen, "Assessing the Economic Contribution of Education: An Appraisal of Alternative Approaches" in Economic Aspects of Higher Education, OECD 1964.

"The Mediterranean Regional Project (MRP) is an attempt by the six OECD Mediterranean countries[1], to relate education to economic growth and social advancement. It is based on the growing realization that education and training, as well as the volume of labour and the amount of physical capital, are an important factor in economic growth. In fact, recent economic research has shown that increases in the input of labour and of physical capital leave a substantial portion of economic growth unaccounted for, thus giving rise to the concept of "the third factor" of production, of which education is presumed to be an important element.

"Now the proposition that the knowledge and skills embodied in a labour force have something to do with its productivity is hardly revolutionary or profound. What is novel, however, is the idea of establishing a kind of quantitative relationship between education and economic growth, in other words, the notion that it is possible broadly to ascertain the investments in education required for achieving specified economic objectives.

"Many attempts have been made to measure the contribution of education to economic growth and to calculate the rate of return to society on investment in education. The aim of these efforts has been precisely to determine whether, from a purely economic point of view, a given expenditure on education was the right one, and to ascertain what educational expenditure would be required for a given rate of growth or level of output. Until now, however, such questions have remained largely unanswered. We cannot estimate with any degree of precision the relative contributions of various types of education to economic development. We cannot, therefore, weigh the advantages to be obtained from increased expenditure on education against those that may be derived from other expenditures aimed at economic growth. Does this mean that planning education with a view to economic development is in fact impossible?

"The contribution of the MRP is that it has asked these questions, not in terms of abstractions to which there can be no answer, but in the real conditions of planning and policy-making in individual countries. All governments must make decisions with regard to education, for no society believes that market forces alone can be relied upon to govern the allocation of resources to education. Despite all the difficulties and uncertainties, these decisions are likely to be more judicious if they are made in the light of careful analysis of economic as well as social and cultural needs - whatever the limitations of such an analysis - than if they are made in a haphazard way. No planner can predict with any degree of certainty the precise number of technologists or qualified technicians required to reach a given production target in a given economic framework. But such precision is hardly necessary, for education, considered as a factor of production, is partly complementary to, and partly substitutable for, other factors of production. A certain margin of error in estimating educational needs can be tolerated and need not affect the overall growth targets; for it might be possible to compensate for any shortage of qualified manpower by increasing the input of other factors of production, or by planning the pattern of of growth more closely in line with the pattern of qualification structure that is available or attainable.

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[1] Greece, Italy, Portugal, Spain, Turkey and Yugoslavia.

"Planning education with a view to economic growth is, therefore, far from being a purely academic exercise of no practical interest. In fact, it is precisely through the implementation of projects such as the MRP, through proceeding by trial and error, that a better insight might ultimately be gained into the relationship between education and economic development.

"It should be noted, however, that the MRP does not concentrate exclusively on econimic criteria in estimating educational needs: it also gives a large place to the social and cultural objectives which education serves and to the demographic trends which underlie such educational needs. In fact, the social and cultural objectives of education cannot be assumed to be unrelated to the process of economic development: a reduction in illiteracy may contribute as substantially to an increase in productivity as the training of additional scientists or engineers. The guiding concept of the MRP has been that of education as a factor which makes a general contribution to the quality of civilized society, though the emphasis is definitely on its contribution to economic development. Economic requirements and criteria provide a first estimate of minimum educational needs: to these can then be added the additional needs derived from the cultural, social and political objectives of education."

B. *Objectives of the Study*

4. The MRP Reports represent one of the first attempts to develop educational plans on the basis of comprehensive estimates of manpower requirements and this makes the task of evaluation complicated. The complication arises because the MRP is a pioneering example of one general type of approach to educational planning. One whishes, therefore, to evaluate both this type of approach, in general, and the MRP experience, in particular.

5. The procedure in this study was conceived with a view to serving both these ends. First, an attempt is made to state clearly some of the basic technical arguments which have been raised against the methods used in estimating manpower requirements for educational planning. Then the data presented in the MRP Reports are used in order to evaluate the importance of these arguments. This latter aspect is particularly important because, to date, arguments about the various approaches to educational planning have been carried on solely in theoretical terms. The MRP provides for the first time the means to evaluate these arguments in empirical terms. By following this procedure, the MRP methods can be examined in light of the basic arguments against them and, at the same time, by using the MRP as a source of data, some indication of the present state of knowledge about the manpower requirements approach in general can be obtained.

6. There was, in addition to this primary set of objectives, a second level of concerns which affected the shape of the study. These considerations influenced the choice of the

methods of analysis. First, methods were chosen which would be commensurate with the rather crude nature of the data to be analyzed, i.e., they could not be very sophisticated methods. Second, methods were selected which could easily be used in the future by those attempting to formulate plans. Third, and closely related, particular methods of analysis were chosen because they reflected a certain attitude toward planning. As will be seen, this attitude places emphasis on the careful consideration of the nature of the uncertainties involved in planning and, as a parallel, it stresses the importance of the indication of, and the choice among, alternatives.

C. *An Introduction to the Methodology and the Structure of the Study*

7. The methodological framework of the manpower requirements approach has been clearly set forth in an early MRP document[1]. It is not necessary, therefore, to describe in detail the steps actually taken in the creation of the MRP plans. As already noted, this study is focused on a limited, but central, portion of the total planning procedures used in the MRP. For this reason, at this point, it will suffice to outline briefly only that part of the manpower requirements approach which is carefully examined in this study. In Appendix 1, a fuller account is provided of the methods and data used by each country in the MRP to project manpower requirements and to convert them into educational requirements. Readers who are not acquainted with the MRP reports may find this Appendix helpful as a means of familiarizing themselves with the approach used in the project.

8. The methodology consists roughly of the following steps:

i) Estimates of total output of the economy - since the logic of the manpower requirements approach is to link the targets of the educational system to those of the economic system, the starting point of the planning exercise must be the establishment of estimates of the target levels of total output in the economy - usually stated in terms of Gross Domestic Product (GDP) or Gross National Product (GNP).

ii) Estimates of sectoral output - since it is generally felt that the changing structure of the economy as well as the level of activity is likely to have an effect on manpower and, therefore, educational requirements, the second step is to estimate the division of the total output among various sectors of the economy in the target year.

iii) Estimates of inverse sectoral labor productivity. In order to link the level and structure of output to the labor force it is necessary to develop estimates of the inverse of sectoral labor productivity, i.e. the number of persons employed per unit of output in the sector. When these estimates are multiplied by the appropriate sectoral output estimate from step 2, the resultant is an estimate of the number of workers required in each sector of the economy in the target year.

iv) Estimates of the sectoral occupational distribution. It is supposed that different types of labour will have to have different types of educational background and, therefore, it is necessary to estimate the number of workers required according to occupation. In order to do this, estimates are formed of the occupational distribution of the labor force within each sector. Multiplying these estimates by the estimates of the number of workers required in each sector, as arrived at in step 3, will give the numbers of workers required in each occupation in each sector of the economy.

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[1] H.S. Parnes, "Forecasting Educational Needs for Economic and Social Development", OECD 1962.

v) Estimates of the total occupational distribution. In this step, the numbers in a given occupation in each sector are added up for all sectors in order to arrive at an estimate of the total number of workers in that occupation required in order to reach the targets of total output.

vi) Estimates of the education associated with occupation. In order to convert the occupational estimates into target estimates of the educational stock in the labor force, estimates must be developed of the kinds of education which are to be associated with each occupation. Multiplying these estimates with the estimates of the numbers required in each occupation gives the number with each kind of education in each occupation.

vii) Estimates of the total educational stock. In this step the estimates derived in step 6 are added up over all occupations for each education level. The resultant figures give estimates of the required stock of the number of workers in the labor force having each type of education.

viii) Estimates of the increment of manpower by education. To convert the estimates of target educational stock into flow estimates, it is necessary to subtract from the estimates of the target stock the number of those already in the labor force, with each education level, who are expected to survive until the target year. This gives an estimate of the increment of manpower by education category which it will be necessary to add to the labor force over the period of the plan.

ix) Estimates of the total graduate flow. Since a portion of the graduates of the educational system do not enter the labor force, the increment of manpower by education category must be multiplied by estimates of the inverse of labor force participation rates of such graduates. The resultant figures will represent the final estimates of the required total flow of graduates over the period of the plan.

9. The structure of this study follows the procedure noted in the previous section. In Chapter II, the basic technical arguments which have been raised against the manpower requirements approach are presented and the questions which they raise are summarized. In Chapter III, empirical analyses are carried out, using the data drawn from the MRP Reports. The empirical examples are designed to be closely related to the questions raised in the previous chapter. Chapter IV is devoted to a brief review of the results and some concluding remarks drawn upon the basis of the analyses. In Chapter V, a more general statement of views about the role of manpower requirements in educational planning is presented. The Appendices provide: a description of data and methods used in each of the MRP, country's manpower requirements forecasts, detailed explanations of methods of analysis used in Chapter III, and the comparative statistics drawn from the MRP Reports which served as the basis for the empirical analysis.

II

PROBLEMS ARISING FROM METHODS OF FORECASTING USED FOR THE MEDITERRANEAN REGIONAL PROJECT: GENERAL EXPOSITION

10. In most countries, formal planning for education policy has been vary limited, although policy decisions have to be taken every day. Recently, there have been more attempts to base educational policy explicitly upon specified long-term objectives, but often proper data for complete, formal planning have not been available. This has necessitated an approach based upon the making of reasonable hypotheses concerning what the future of the society requires of present educational policy. This has sometimes been called "planning without facts". The Mediterranean Regional Project National Reports represent attempts to move beyond this rudimentary stage in educational planning. Considerable care was taken to gather available data and create new data in order to formulate plans more solidly grounded on "facts".

11. The type of "perfect" information which is desirable for planning was not, of course, available. Enough data existed, however, to construct plans which would give meaningful guidance to policy-makers. If policy-making is to be affected by planning in the near future, planners cannot wait until "perfect" information is available. The MRP Reports were consciously formulated on this basis in the face of time and resource constraints.

Now, however, these Reports themselves are a source of "facts"; as such they should be objectively examined to see what additional information they can yeild on the problems facing those who seek to plan educational policy.

12. The Reports are a pioneering effort in the application of the manpower requirements approach to educational planning. Their existence as an embodiment of this approach provides a unique opportunity to seek answers to several fundamental questions about the validity of this approach. Because of this original venture there is, for the first time, some hope of facing these questions in the realm of quantitative reality rather than a theoretical vacuum. Many variables which could affect the relationship between education and the economy have been suggested; now, because of these Reports, some indication may be obtained about which of these variables are, in fact, most important.

13. This section of the Technical Evaluation of the MRP is to be largely devoted to an examination of these questions about the manpower requirements approach in the light of

the experience of the MRP. This chapter contains the preliminary statement of the questions. The empirical analysis relevant to these questions is presented in Chapter III.

14. The list of questions reviewed in this chapter should not be allowed to dim the impressive dimensions of imagination and effort embodied in the MRP Reports. It is all too easy, in reviewing these questions and seeking their answers, to forget that such a review has been possible only because of the considerable advances made by the authors of these Reports - in spite of the handicaps of limited time, data and other resources.

15. In section A, a statement on the quantitative terms of reference of the study is presented. In sections B through G, the questions about method are reviewed. The most general form of the question concerning the manpower requirements approach is presented in Section B. Sections C through G contain a review of the fundamental problems which might lead to errors in manpower estimates, and an examination of variants of technique.

A. The Limits of the Quantitative Analysis

16 In this review, the data utilized in the MRP Reports will not be questioned as to reliability nor will alternative sources of similar data be heavily drawn upon to supplement or revise the work carried out in the Reports. Bearing in mind the limited amount of resources and of time in which the Reports had to be written, it is reasonable, in a technical evaluation, to assume that those responsible for the Report did the best that could be done to find data and to verify their reliability. Quantitative analysis in this evaluation, therefore, has been based almost entirely upon the data provided in the Reports.

B. Impact of Manpower Requirements on the Educational System

17. The most general manner of questioning the use of manpower requirements for educational planning is to ask whether, in fact, manpower requirements have, or should have, any impact on the character of the educational system. Critics of the manpower requirements method have constructed two lines of attack between which they seek to catch advocates of this approach. The first is that manpower requirements are not very important. They argue that the educational system will grow roughly as the economy and the labor force grow and that is all that is required; that is to say, the quantitative impact of manpower requirements on the educational system will not be very significant, and therefore elaborate and involved calculations of those requirements are not justified. The second line of technical argument is quite different. It is that the methods of manpower projection are so weak that manpower requirements cannot be estimated with any degree of certainty. In this view, even if manpower requirements could have an impact on educational planning, the nature of present methods is such that any estimates are liable to contain large errors and that, therefore, no planning should be based upon these doubtful procedures. The specific weaknesses of method will be more fully detailed in the following sub-sections.

18. One of the two lines of attack taken by critics is more destructive than the other. If it should be found that manpower requirements, in fact, have very little potential impact on the educational system, then the elaborate estimations of requirements would hardly be justified and other methods for planning would have to be adopted. If, on the other hand, the impact is potentially significant but the possibilities for error prove large, more intensive efforts to improve estimation methods would be called for; a potentially effective method for educational planning would have been found but greater care would have to be taken in using it.

19. The only way to escape this dilemma entirely is to show both that manpower requirements could potentially have a major impact on the educational system and that possible margins of error in estimating requirements are small (or at least small relative to those inherent in alternative planning methods). None of the MRP Reports alone provides these proofs, nor can this evaluation, based on all these Reports, meet that test. However, some analyses can be made which provide partial information on these issues. Such analyses will be considered in Chapter III.

20. Before proceeding to these analyses, it is necessary to state more fully some of the weaknesses in the manpower requirements method which critics have suggested will lead to errors in requirements estimates.

C. *Productivity Estimates and the Occupational Structure*

21. Estimation of future productivity levels - output per worker - is one of the most serious problems to be dealt with in constructing manpower projections related to economic output. The fact that these estimates are likely to be a source of significant error in such projections is suggested by analysis of past productivity trends[1]. Studies show that the advance of productivity is quite irregular both over time and among economic sectors. These irregularities have not been convincingly linked to any secondary factors. For this reason, it must be presumed, at present, that it is not likely that estimates of future productivity levels will be accurate.

22. In the MRP Reports the productivity problem appears at two levels: first, in the estimation of the occupational structure within the sector. The problem at the sectoral level is a problem which all economic planning and forecasting must face. As is indicated in the review of methods presented in Appendix I, in most of the MRP countries estimates of sectoral productivity made for existing plans or forecasts were available for use in constructing the MRP manpower requirements estimates. Since the rationale of the manpower requirements approach is to put educational decision-making in line with economic decisions, it is reasonable, where official or semi-official planning or forecasting agencies exist, to accept such estimates of factors as these bodies can provide, e.g. productivity.

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[1] The most complete study of such trends to date is J. Kendrick, "Productivity Trends in the United States". National Bureau of Economic Research Study, Princeton University Press, 1961.

In general, the MRP planners made use of such estimates. Exception to this general procedure would arise only where the manpower analysis itself gave rise to constraints which the economic plan or forecast had not taken into account. This point will be reconsidered below.

23. At the occupational level, the productivity problem arises because it is only reasonable to expect that productivity changes will require changes in the occupational structure within a sector. As noted in Appendix I, a number of methods for predicting this effect are available and several were used in the MRP Reports. Shifts in the occupational structure within sectors were estimated by extrapolating trends in structure from past periods. The occupational structure of leading firms was used as a predictor of the future average pattern in the sector. International comparisons of occupational structure were used in a variety of ways. "Special factors" such as the size of the sector, planned expansion of large firms, changes in the organizational structure within both sectors and firms provided grounds for other adjustments in occupational estimates. Sociological analysis of job tasks was attempted, in one case, as a means of defining an "optimum" structure of occcpations for the future. Employer estimates of future occupational needs were sometimes used. The difficulty is, however, that there is virtually no evidence as to which of these methods, if any, provides reliable estimates of future occupational structure. No analysis has yet come to light which compares estimations of occupational structure made on the basis of one or more of these methods with actual historical changes in that structure. No sound empirical basis for evaluating these methods has yet been explored, though such analysis is conceptually possible. Some indication of the lines which such analysis might take is provided later in this study.

D. *The Effects of Supply Conditions upon Amount Demanded*

24. While, as just noted, a variety of methods were used to estimate future occupational structure in each sector, in the MRP Reports, it was generally assumed that at a given point in time, a given level of output in a particular economic sector would require a fixed amount of workers with particular types of skills, i.e. fixed occupational input coefficients[1] (or, it might be argued, it was assumed that a given productivity level in a given sector required fixed numbers in various occupations). This has been the usual assumption in manpower planning and critics point out that, when estimates have been formed on the basis of extrapolation or of international comparisons, no consideration has been given to the possibility that a particular level of output (or productivity) could be achieved with a variety of inputs.

25. It is perhaps helpful to point out that this criticism is really a form of an old and continuing argument in economic theory about whether, at a given point in time, input coefficients can be varied in response to differences in relative supplies of various inputs,

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[1] Here and below occupational coefficient is defined as the number of workers in an occupation in a sector per unit of sectoral output.

e.g., capital and labor, without changing the level of output (or productivity). This has sometimes been called the question of the effects of conditions of supply upon the amount of various inputs demanded; it has also been called the substitution question.

26. It is necessary to follow this point a little further in technical terms in order to avoid confusion. At a given point in time either of two technological states exist; for a set of levels of output (or productivity) in a sector, a) input coefficients are fixed or, b) input coefficients can be varied in response to changes in the supply of various inputs. However, when input coefficients for a given sector level of output (or productivity) are looked at for two different periods of time, these coefficients could differ either a) because the state of technological knowledge changed, or, b) because relative supplies on inputs changed and substitution occured, or, c) because of a combination of a) and b). It is important to distinguish between changes in input coefficients which occur because of changes in technological knowledge and those which occur, with technological knowledge constant, because of the existence of substitution possibilities.

27. In the MRP Reports this distinction was, in general, not clearly made. The changes in productivity which were estimated for the plan period were generally taken to reflect the changes in the state of technological knowledge, but the possibilities of substitution - and therefore the effects of the conditions of supply on the amount of various types of labor demanded - were not explicitly considered.

28. The importance for manpower planning of considering substitution possibilities - supply effects on amount demanded - occurs at two levels. The first has to do with the use and interpretation of observed data on occupational inputs. The second has to do with the projection or forecast of occupational inputs.

29. The importance at the first level becomes clear if the following question is asked: are presently observed occupational inputs solely determined by the pattern of economic outputs or do they reflect, as well, the relative supplies of various types of labor which are available. Only in the Yugoslav Report is this point explicitly raised. It states[1] that changes in the educational system had led to a large increase from 1956 to 1960 in the relative supply of workers with higher qualifications, and that the absorption of these workers was reflected in the numerical relationship of personnel with high qualifications to other types of labor, as observed in 1960. Thus the trend in occupational structure from 1956 to 1960 probably reflected not so much a change in the technological conditions of demand as a change in the relative supplies of types of labour.

30. The importance at the second level is obvious if it is asked: what if the future occupational structure for various sectors in Yugoslavia were to be estimated by extrapolating the 1956-1960 trend, or, what if another country, basing their estimates of occupational

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[1] MRP Country Reports: Yugoslavia, OECD, 1965, pp. 82-96. Also note that the Yugoslavia classification is a mix of occupational and educational qualification, as noted in Appendix I below.

input requirements on international comparisons, used the Yugoslavia 1960 data as a basis for determining their future target? In both cases, the effects of the unique supply conditions in Yugoslavia in 1960 would introduce biases in the estimates for the future. The existence of substitution possibilities, and therefore supply effects, is important at this second level, not only because it can introduce such biases into the estimates for the future, but also because it suggests that even for a projected given level of sectoral output (or productivity) there may be not one set of occupational inputs but several alternative occupational input patterns to be considered.

31. It is not surprising that users of the manpower requirements approach have generally overlooked these supply effects. The rationale of the approach is dominated by the view that an economic plan or forecast is already given and that this generates a unique set of demands for various types of labor, which the educational system must be adjusted to supply; it is an exclusively demand rationale. But the failure to differentiate supply effect from other factors influencing the occupational structure can, as the example cited above suggests, introduce serious biases into the estimates of manpower requirements. Manpower requirements are estimated, in the case of educational planning, in order to determine the conditions of supply of various types of labor. But if the estimating procedures themselves are biased by the supply effects of the past, then there is a serious element of indeterminacy in the procedures - the conditions of supply determine the conditions of supply.

32. The MRP Reports - aside from that of Yugoslavia - got around the indeterminacy introduced by supply effects by assuming that occupational coefficients are not responsive to relative occupational supplies; it was implicitly assumed that a change in the supply of one occupation relative to another would not induce a change in sectoral occupational inputs. This assumption is not necessarily incorrect, though the Yugoslav experience noted above suggests it might be. Empirical evidence was not presented in any of the Reports to support this assumption.

33. To reiterate, if, in fact, supply effects on demand are important, then the manpower requirements approach becomes much more complicated. First, methods of deriving estimates by trend extrapolation, international comparison, or by using leading firms as predictors, will all be subject to bias - since they are all based to some extent on observed occupational inputs which are influenced by supply effects. Secondly, the derivation of a single set of manpower requirements relating to a given economic plan of forecast must become more complicated. If substitution is possible, then a wide variety of occupational patterns will be consistent with the given economic plan or forecast and the problem will be to choose a single "optimum" set of occupational requirements from among the range of alternatives.

34. There are several criteria, both economic and social, which might be applied in order to select an "optimum" set of occupational requirements from among alternative sets. This

is not the place to explore these criteria and the ramifications of their use[1]. It must suffice to mention a single one as an example; the criterion of cost-minimization. For instance, if there are several sets of occupational requirements which would be consistent with the given economic plan or forecast then one would choose that set which would require the least cost in terms of educational expenditure.

35. It should be kept in mind that there are two facets to the problem of supply effects upon demand with respect to educational planning. The first concerns the relationship between the economic outputs and the occupational inputs. The second involves the relations between occupations and the educational requirements for these occupations. Thus the relationship between the educational system and a given pattern of economic outputs might vary because of either of these two possible levels of effects. For instance, technology might be such that there is a fixed coefficient relating output in the manufacturing sector and the number of engineers employed in that sector - no supply effects at the first level - but there might be a number of different educational patterns which could produce an engineer - supply effects at the second level; the relation between output in manufacturing and the educational system would be variable because of the possibilities of substitution at the second level even though there are no opportunities for substitution at the first level. The question of the relation between occupations and education is more fully discussed in sub-section F.

36. In two of the MRP Reports, problems explicitly recognized by the authors could have led logically to a careful consideration of substitution possibilities - that is, supply effects.

37. In the Turkish Report, it was found that the projected requirements for 1975 for Class C workers - predominantly skilled industrial workers and skilled sales and clerical workers - could not possibly be met because of real limitations upon the rate at which the segment of the educational system "producing" these workers could be expanded[2]. It was decided that this deficit would be met by training the additional Class C workers required through vocational programmes. This is clearly a case of substituting one educational programme for another - the second level supply effect discussed above. It is curious that the assumed ability to vary the educational requirements for an occupation group did not lead to a more general consideration of substitution possibilities, at both levels, and thereby to the effects of supply conditions upon demand.

38. Similarly, in the Italian Report, it was found that because of limitations on the obtainable rate of growth of the educational system one third of the estimated requirements could not be met[3]. The report hints that perhaps substitutions of other inputs will be required but does not follow up this lead to revise estimates in the light of this possibility.

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1. Alternative criteria are discussed briefly on p. 38.
2. MRP Country Reports: Turkey, OECD, 1965, pp. 42-52.
3. MRP Country Reports: Italy, OECD, 1965, pp. 103-104.

39. These two examples also serve to illustrate a point raised in the previous sub-section. In both cases the manpower analysis started from output and productivity figures given by official or semi-official organisations. The manpower analysis led to a set of estimated requirements which could not be fulfilled because of real constraints upon the growth of the educational system. The next logical step would be either to re-examine the methods used to derive the manpower requirements - for instance by trying to take into account substitution possibilities - or force a revision of the output and productivity estimates made by the official or semi-official organisations. The Italian Report explicitly recognizes this logical step[1] but does not carry it out. The Turkish Report - as has been pointed out - avoids the full implications of the fact by assuming second level substitution is possible in a single case.

40. These cases suggest that consideration of skilled manpower constraints needs to be more fully integrated into the total economic planning process and that methods of estimating requirements for manpower need to be more complex. If response to relative supplies of manpower by adjusting input coefficients is not possible, the problem of real manpower constraints must be taken into account in planning or forecasting output. If adjustments in manpower inputs in response to supply are possible, manpower estimating techniques should reflect this possibility.

E. The Degree of Disaggregation

41. A question which has been raised several times with respect to manpower requirements is: What degree of disaggregation is necessary to obtain reasonably accurate manpower requirement estimates? The range of degrees of disaggregation suggested has been quite wide. The earliest models of Correa and Tinbergen[2] related education levels directly to GNP. Disaggregation from this point has followed two lines: first, disaggregation of GNP into sectors and sub-sectors; secondly, insertion of the occupational distribution of the labour force between the output estimates and the educational requirements - and, still further, more and more refined breakdowns of occupation groups. Attempts to establish the most reliable degree of aggregation on theoretical grounds quickly run into complex difficulties. Judgment, based on piece-meal empirical evidence, will probably continue to be the grounds upon which the level of aggregation is determined for some time to come.

42. The MRP Reports, with the exception of Portugal, disaggregated GNP into at least eight economic sectors, and in the Greek and Spanish Reports disaggregation of sectors into sub-sectors is alluded to. Analyses for other countries may have carried disaggregation to the sub-sector level, though it was not mentioned in the Reports. The degree of occupation disaggregation varied quite widely, from six categories for Italy to 62 for Greece.

[1] MRP Country Reports: Italy, OECD, 1965, pp. 103-104.

[2] "Quantitative Adaptation of Education to Accelerated Growth". Kyklos, Vol. 15, 1962.

43. Two general, different reasons for considering high degrees of disaggregation desirable can be briefly described here. The first depends upon the characteristics of the educational system. The educational programme for certain highly specialized skills may be quite long and also quite specific in content to the particular skills. If such skills are believed to be closely related to economic activity then a special occupational category would be required for them (on these grounds it is reasonable to establish separate categories for engineers as opposed to administrators but not for barbers as opposed to firemen). It would then be necessary to see whether workers with these skills are concentrated in particular economic sectors. If so, projections would have to be disaggregate enough to trace the particular development of those sectors. If such skills were concentrated even more in particular sub-sectors, further disaggregation would be required.

44. The second reason for considering disaggregation would be to improve the reliability of estimates. Reliability of estimates depends upon the stability of the relationship between the variable estimated - in this case occupational or educational requirements - and the independent variables - in this case economic indicators. The case where disaggregation of the independent variables is desirable is perhaps best illustrated by means of a hypothetical example. Suppose the problem is to estimate the requirement of engineers in the economy and the independent variable to which engineers are to be related is GNP. Further, assume that engineer requirements are closely related to output in the Manufacturing sector but are not closely related to output in another sector such as Commerce and Finance. Now suppose that movements in the level of output in Commerce and Finance dominate the movements in the aggregate variable, GNP. It is clear that in such a case a better estimate will be obtained if the variable GNP is not used in an aggregate form but is disaggregated so that the component stability of the engineering-Manufacturing relationship can emerge and the disturbing component, Commerce and Finance, can be separated out.

45. On the other hand, stable estimating relationships for a variable are sometimes discovered by aggregating variables whose movements have conflicting influences on the estimated variable - thus component instability may be cancelled out in the aggregate. The desirable degree of disaggregation must be determined in view of these two opposing possibilities.

46. Attempts to answer the questions concerning degrees of disaggregation are important in order to judge better the reliability of the estimates obtained and also to make better use of the human and financial resources for the development of estimates. A great deal of energy can be spent on obtaining finer degrees of disaggregation and it may well be that these refinements do not substantially increase the reliability of the estimates.

47. In addition, this question is important because some critics have argued that the relationship between output and educational inputs is so complex that it can only be reliably estimated by projecting requirements formulated at the level of individual firms and that, since data for such estimates cannot be collected, the manpower approach should be abandoned.

F. *Occupational-Educational Relationships*

48. The manpower requirements approach, as used in the MRP, puts a great deal of emphasis on the estimation of the numbers required according to occupation. But if these occupational estimates are to be used for educational planning, a means must be found to convert the estimates of occupational requirements into educational equivalents. Both advocates and critics of the manpower approach agree that we know very little about the relationship between particular occupations and the education they require.

49. Therefore, the weakest link in the analytical chain which constitutes the manpower requirements method is the conversion of occupational estimates into educational estimates. In fact, the determination of these relationships meets with problems analogous to each of those described in the previous three sections; there exist productivity, supply effect and disaggregation problems related to the conversion of occupation to education requirements. More important, the amount of information available on past occupational-educational relationships is very limited.

50. The productivity problem with respect to occupational-educational relationships has two aspects. First, changing knowledge of technological processes may require a derivative change in the educational input for a particular occupation, e.g. introduction of data processing machines, a change in the type of training for clerical workers (this may be either more or less complex training). Secondly, changes in educational knowledge and processes may change the educational input for a particular occupation, e.g. improved science curricula may allow the acquisition of technical skills with fewer years of education.

51. Supply effects upon the occupational-educational relationship were touched upon in Section C - they constitute a second level of substitution possibilities. It may be possible to fill a given occupation group with a wide variety of educational inputs, without seriously affecting productivity. If this is the case, other criteria, such as relative costs, are needed to select among the possibilities.

52. The aggregation problem occurs here since the question arises as to whether the educational requirements for a given occupation are the same regardless of the economic sector in which the occupation is carried out; in other words, is a three-way cross-classification: education, occupation and economic sector, required?

53. Useful comparative information on educational-occupational relationships is particularly difficult to obtain because of the differences among countries in the institutional characteristics of educational systems. As described in Appendix I, because of this limited information educational-occupational conversions in the MRP Reports were for the most part based upon judgment. In some cases trends in educational attainment for various occupations were extrapolated and some vague international comparisons were alluded to. Knowledge about the factors affecting the relationship between occupations and educational requirements is still extremely rudimentary.

G. *Sensitivity analysis*

54. There are no simple answers to the problems described in the preceding sections. There is, however, a very simple technique which can be used tentatively to determine the relative importance of these problems. This technique can be called sensitivity analysis. It amounts simply to varying key parameters, variables or assumptions and then calculating the sensitivity of final estimates to those variations.

55. In Chapter III of this paper empirical examples are presented of the application of sensitivity analysis to the data from the MRP Reports. These examples provide some insight into the scope of the problems discussed thus far.

56. Sensitivity analysis can be used not only for the purpose of shedding light on these specific problems but can also be introduced more directly into the planning process. In planning itself, sensitivity analysis has three distinct uses. First, testing preliminary estimates by sensitivity analysis would help planners focus their attention for further study upon those parameters, variables and assumptions to which final estimates prove particularly sensitive. This would allow improvement of estimations by a series of successive approximations.

57. The second and third uses are closely related to the function which estimates, such as those presented in the MRP, are to serve. If these estimates consist of documents which are to aid decision-makers - for instance, ministers of education and labour - they should allow for the exercise of the decision-makers judgment, that is, they should present alternatives for choice. The second use of sensitivity analysis would be in the presentation of such alternatives: at points where uncertainty remains about key parameters, the parameters could be varied over the range of uncertainty and the effect on the final estimates reflected. Presented in this form, final estimates would reflect a range of uncertainty and the decision-maker would be allowed to make judgments about the most reasonable values within this range or would be able to adjust policy decision in view of the degrees of uncertainty about estimates.

58. The third use of sensitivity analysis would also generate sets of alternatives for decision-makers. In this use the analysis would be viewed as a crude substitute for the type of cost-benefit analysis which is commonly suggested as a basis for decision-making in the public sector[1]. Recognition of the difficulties of quantifying the "benefits" or "output" of education was perhaps the major factor in the creation and acceptance of the manpower requirements approach. Even granting such difficulties, there is some room in this approach for a type of pseudo-cost-benefit analysis through sensitivity analysis. For instance, in all the reports assumptions were made about the ratio of pupils to teachers and pupils per classroom (or floor space per pupil). These ratios were generally taken to

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[1] See, for instance, Otto Eckstein, "A Survey of the Theory of Public Expenditure Criteria" in "Public Finances, Needs, Sources and Utilization", National Bureau, Princeton University, 1961.

be a rough index of quality. It would have been quite simple to vary these ratios and calculate the effect of the variations on total costs. (An empirical example of this type of analysis is presented in Chapter III). Decision-makers would have their own opinions about the degree to which lowering the pupil/teacher ratio would improve the quality of the education and they would be able to balance these assessed benefits against the explicitly defined increase in costs. Other "policy variables" might be treated in a similar fashion.

H. The Questions Raised

59. Before turning to the empirical analysis, it is useful to review the general questions that have been raised as basic criticisms of the manpower approach.

1. Is the quantitative impact of manpower requirements on the educational system likely to be very significant?
2. To what degree do uncertainties about productivity change (technological change) affect estimates of manpower requirements?
3. Are occupational input coefficients at a given point in time fixed or variable, and how much difference would it make if they were variable rather than fixed?
4. To what degree must the economic structure and the labour force be disaggregated in making estimates, i.e., must separate estimates be made for economic sectors, industries, or firms and how far must the labour force be broken down by occupations if reliable estimates are to be made?
5. What difference does the general ignorance of occupational-educational relationships make in the determination of the usefulness of educational requirements estimates derived from projections of manpower needs?

60. As stated at the outset of this chapter, the empirical analysis which follows cannot provide definitive answers to all these questions. But they can provide some partial steps toward answers and give some indication of the present state of knowledge about the manpower requirements approach to educational planning.

III

PROBLEMS ARISING FROM METHODS OF FORECASTING USED FOR THE MEDITERRANEAN REGIONAL PROJECT: SOME EMPIRICAL ANALYSES

61. This part of the paper describes empirical examples which have been constructed on the basis of the data in the MRP Reports. These examples were chosen with two purposes in mind: first, to seek further concrete information relevant to the problems discussed in Chapter II; secondly, to illustrate an empirical approach which might be helpful to planners in the future.

62. For each of the problems noted in the previous chapter there is some sort of pertinent empirical evidence in the group of examples described. The order of presenting the problems in this part is not the same as in Chapter II, however. The order in this chapter reflects an increasing complexity of analysis. This allows for greater economy of description and, it is hoped, familiarity with the methods used in the more simple examples will help the reader when he comes to the more complex ones.

63. In Section A, an example is given of sensitivity analysis applied with a view to cost-benefit decisions - as suggested in Chapter II. Section B is devoted to a brief introduction to the general comparative data which have been compiled on the basis of the figures in the MRP Country Reports. Since these comparative data are used in the examples described below, it is important that the reader be aware of their nature and limitations. In Section C empirical work relevant to the question of supply effects discussed in Chapter II is described and both intercountry comparisons and sensitivity analysis are used. Section D concentrates on analysis of the determinants of the estimates of the occupational distribution of the labour force. The method of analysis used is similar to sensitivity analysis but is slightly more complex. The productivity problem, and the question of degree of disaggregation, introduced in Chapter II, are partially examined here. The most complex analysis is presented in Section E, and concerns the question of the impact of manpower requirements as described in Chapter II; the problems of occupational-educational relationships are also considered in the analysis in this section. The empirical work combines sensitivity analysis and the method used in Section D.

A. A Simple Example of Sensitivity Analysis: Variation in the Pupil/Teacher Ratio

64. In Chapter II, it was suggested that sensitivity analysis might serve as a crude substitute for cost-benefit analysis. Using the data from the Greek Report, a simple empirical example was drawn up to illustrate this possibility.

65. The objective of this example was to point out a way in which information might be presented to educational or financial decision-makers and which would clearly define the relative costs of one or more of the educational choices. With the costs of the choice clearly defined, the decision-maker can apply his own estimate of the benefits (since these benefits are difficult or impossible to quantify) and make a decision weighting relative costs and benefits. From among several possibilities a simple example was selected that could be applied to the problem of making decisions about improving the "quality" of education over the period of the plan. The example consisted simply of changing the pupil/teacher ratio assumed for 1975 and then tracing through the effect of this change on the estimate of current costs in 1975.

66. In most of the MRP Reports, the index used to indicate the "quality" of education was the pupil/teacher ratio. Many experts do not accept the pupil-teacher ratio as a good index of the "quality" of education. In fact, one sophisticated quantitative study of the United States educational system[1] provided convincing evidence that there was little correlation between the pupil/teacher ratio and the "quality" of education. In the Turkish Report there was some discussion of the relationship between pupil/teacher ratio and the results of examinations[2]. Even if the Turkish evidence that examination results decline with increases in the pupil/teacher ratio is accepted - in spite of the United States evidence to the contrary - it does not follow that this ratio must be maintained or "improved". This will depend first on whether the examinations test the skill that concern the objectives of the educational plan - for instance, increased economic growth. Then, even if the examinations do serve this end, it must be asked: how much is society willing to pay - in monetary or opportunity costs - to prevent such a deterioration or to realize an improvement by lowering the pupil/teacher ratio still further?

67. In spite of these reservations about the usefulness of the pupil/teacher ratio as a "quality" index, an empirical example was constructed to show the cost of "improved quality", due to planned reductions in pupil/teacher ratios, which were built into the Greek plan. A measurement of the sensitivity of costs to changes in the assumed pupil/teacher ratio was examined on the basis of the data in the Greek Report.

68. This example was created simply by calculating what current costs would be for the plan period if the pupil/teacher ratio remained at the 1961 level rather than being lowered as suggested in the Report.

[1] Project Talent, University of Pittsburgh, Pittsburgh, Pa. 1964.

[2] See p. 80. .

69. For instance, in the Greek Report it was suggested that the ratio in 1974 in secondary education should be about 24 pupils per teacher. In 1961 the pupil/teacher ratio for secondary education was recorded at about 28 pupils per teacher. A new estimate of teacher requirements for secondary education was made by taking the Report estimates of 1974 secondary enrolment but applying the 1961 ratio of 28 rather than the 1974 estimate of 24 pupils per teacher. The resulting requirements were then multiplied by the 1974 average salary for secondary teachers as estimated in the Report. This gave a new estimate of total secondary teacher salary costs in 1974 to which were added the 1974 estimates of "other current expenses" for secondary education as provided in the Report. This new estimate of total current expenditures was compared to that in the Report, the difference between the two representing the increase in cost which is due to the reduction of the pupil/teacher ratio.

70. The estimates of costs in 1974, assuming the 1961 pupil/teacher ratio, those made in the Report on the basis of a lowered pupil/teacher ratio, and their difference as a percentage of the Report cost estimates for 1974 are shown in Table A.

71. In all, about 15 per cent of estimated total current costs in 1974 are due to the suggested lowering of pupil/teacher ratios; for higher education alone, this factor accounted for 20 per cent of the current costs estimated for 1974 (it is, perhaps, clearer to say that estimates of 1974 current costs would be 15 to 20 per cent lower if pupil/teacher ratios remained at 1961 levels)[1]. Clearly, similar calculations could be made to cover the whole plan period rather than only the final year.

72. These estimates of the costs of lowering pupil/teacher ratios should not be in any sense taken to imply that lower ratios are not desirable, or not worth the price. This would be a judgment to be made by the appropriate authority within the context of the alternative educational choices available and the explicit or implicit goals toward which educational activity is directed. However, with this type of cost information in hand such an authority can make a more balanced judgment as to whether the benefits expected to accrue from lower ratios clearly outweigh the increase in costs. It is not enough to conclude, as most of the MRP Reports did, that lower ratios mean higher quality and, therefore, should be built into the plan. With limited resources, all actions that are judged to be good for society cannot be undertaken. Thus, in deciding priorities, it is very important to have the opportunity costs clearly shown.

73. Similar types of sensitivity analysis could be carried out to illustrate the relative importance of other key choices within the framework of the plan, e.g. changes in the pupil-classroom ratios could be traced through to costs. This empirical example using pupil/teacher ratios was presented to illustrate this type of analysis.

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[1] The assumption has been made that "other current expenses" would not be affected by differences in the pupil/teacher ratio.

Table A. GREECE: ESTIMATED CURRENT COST TO IMPROVING PUPIL/TEACHER RATIOS IN 1974

	ESTIMATED ENROLMENT 1974	PUPIL/TEACHER RATIOS		CURRENT COSTS[3] PROJECTED 1974 (million drachmae)		SALARY PER TEACHER 1974 (thousand drachmae)	NUMBER OF TEACHERS REQUIRED IN 1974 ASSUMING THE 1961 PUPIL/TEACHER RATIO	TEACHERS' SALARIES ASSUMING 1961 PUPIL/TEACHER RATIO (million drachmae)	TOTAL CURRENT COSTS 1974 (million drachmae)		DIFFERENCE AS % OF 1974 PROJECTION
		1974	1961	SALARIES	OTHER EXPENDITURE				ASSUMING 1974 PUPIL/TEACHER RATIO	ASSUMING 1961 PUPIL/TEACHER RATIO[6]	
PRIMARY: total	891,000	29.4	38.5	2,525	275	83.3	23,320	1,941	3,800	2,216	-20.9
public	(818,000)	(29.7)	(39.9)	(2,300)	(250)	(83.6)	(20,501)	(1,714)	(2,550)	(1,964)	(-23.0)
private	(73,000)	(26.1)	(25.9)	(225)	(25)	(80.4)	(2,819)	(227)	(250)	(252)	(+0.8)
SECONDARY: total[5]	456,500	24.1	28.0	2,309	611	121.8	16,530	1,991	2,920	2,602	-10.9
public	(369,100)	-	(36.3)	(1,740)	(410)	-	-[4]	-	(2,150)	-	-
private	(87,400)	-	(17.1)	(569)	(201)	-	-[4]	-	(770)	-	-
of which:											
general	370,000	26.2	31.0	1,709	211	121.2	11,472	1,365	1,920	1,576	-17.9
public	(318,000)	(30.0)	(40.2)	(1,380)	(170)	(130.2)	(7,910)	(1,030)	(1,550)	(1,200)	(-22.6)
private	(52,000)	(14.9)	(14.6)	(329)	(41)	(94.0)	(3,562)	(335)	(370)	(376)	(+1.6)
technical/vocational[1]	86,500	17.8	17.1[2]	600	400	123.7	5,058	626	1,000	1,026	+2.6
public	(51,100)	-	(6.6)[2]	(360)	(240)	-	-[4]	-	(600)	-	
private	(35,400)	-	(21.7)[2]	(240)	(160)	-	-[4]	-	(400)	-	
HIGHER: total	45,500	15.4	22.5	495	155	167.8	2,121	356	650	511	-21.4
of which:											
science faculties	(18,900)	(9.9)	(13.8)	-	-	-	(1,370)	-	-	-	
other faculties	(26,600	(25.3)	(35.4)	-	-	-	(751)	-	-	-	
TOTAL: all levels	1,393,000	26.7	34.6	5,329	1,041		41,971	4,288	6,370	5,329	-16.3
public	(1,232,600)	-	(38.4)	(4,535)	(815)		-	-	(5,350)	-	-
private	(160,400)	-	(20.0)	(794)	(226)		-	-	(1,020)	-	-

1. Excludes agricultural education.
2. Not taking into account part-time equivalents.
3. For private education, no breakdown is given in the Greek Report between salaries and other current expenditure. It has been broken down in the same proportion as prevails in public education.
4. This figure has not been calculated because of the abnormally low pupil/teacher ratio shown for public vocational education. This is due to the fact that the number of part-time teachers has not been given as full-time equivalents.
5. Totals of current costs are the sum of general and vocational.
6. Other expenditure is assumed to be the same as that projected for 1974.

B. An introduction to the comparative data[1]

74. A set of basic tables containing base year output and occupational data as well as projections for the target year were constructed from Report data on a similar classificatory framework for as many of the countries as possible. Even though the countries started from a similar methodological framework, the comparability of the data was still quite limited, and quite frequently even the comparisons provided in the tables could be obtained only with some forcing of the data. These data form the basis of several of the empirical examples, described below, which were carried out to investigate the problems outlined in Chapter II. An attempt has been made in the notes accompanying the various tables to indicate the limitations of comparability. In the description of the examples based upon the tables, and in the conclusions drawn from these examples, warnings about the underlying weakness of the data are repeated. Data in this study should be considered relevant only to the purposes of the study and should not be used for other purposes. Those wishing to use these types of data are urged to consult the MRP Reports themselves or the sources cited in the Reports.

75. Since these tables are used as a basis for the empirical examples discussed in subsequent parts of this paper, only a few notes of commentary on the data are provided at this point.

Tables H, I. DISTRIBUTION OF EMPLOYMENT BY OCCUPATIONAL CATEGORIES AND DIVISIONS OF ECONOMIC ACTIVITY

76. In these tables an attempt has been made to present a cross-classification of the labour force by occupation and economic sector comparable for as many of the six countries as possible.

77. The problem, of course, is to achieve comparability in the classification of occupations and economic sectors. Most of the countries used the International Standard Industrial Classification for economic sectors. Comparability of the data in this direction seems relatively good. There were considerable differences in the occupational classifications used in the Reports, although most of the classifications were derived by aggregating in different ways occupational categories based upon the International Standard Classification of Occupations. It is hoped that the notes attached to the tables will serve as adequate warning concerning the possible non-comparability among countries of the occupational groups.

78. In Tables H and I, the percentage occupational distribution of the labour force within the sector has also been calculated. This permits simple comparisons of the distribution for a sector among countries in both the base year and the target year. It can also be used to determine whether the differences in distribution among countries for any sector are expected to narrow or widen over the plan period.

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[1] These data are presented in Appendix V.

79. For both tables the percentage distribution of each occupation among sectors was also calculated. This type of calculation is helpful in determining whether a particular occupation is highly concentrated in one or two sectors or is fairly evenly spread among sectors. Where the occupation is highly concentrated in a few big sectors, further disaggregation of those sectors may be desirable in order to improve estimates since changes in these occupations would be particularly sensitive to changes in these sectors. For example, for three countries over 50 per cent of scientific and technical workers were in the government sector.

Tables J, K. GROSS DOMESTIC PRODUCT BY SECTOR OF ORIGIN

80. The sectoral distribution of Gross Domestic Product is reported in local currency in Table J and in United States dollars in Table K. The conversion factor used to translate to dollar terms was the official exchange rate. Even though there has been considerable discussion in economic literature of distortions caused by the use of exchange rates for this purpose, no simple alternative to this method is currently available. Table J, in local currency terms, was included to facilitate the use of other conversion factors if so desired.

81. The expected changes in the pattern of sectoral distribution were largely similar. A significant decline in the percentages of GDP in Agriculture and a rise in Manufacturing are the dominant expected changes in all cases. A large decline in the Government and Other Services sector percentage in Italy and a rise in Turkey, and a rise in Turkey in the relative importance of the Banks and Insurance sector are other notable expected changes.

Table L. EMPLOYMENT BY MAJOR DIVISIONS OF ECONOMIC ACTIVITY

82. This table was included because occupational breakdowns for Turkey and Yugoslavia, cross-classified by economic sector, could not be made to fit into the framework used in Tables H and I, but total labour force cross-classified by sector could be made comparable for all six countries.

Table M. PRODUCTIVITY TRENDS BY MAJOR DIVISIONS OF ECONOMIC ACTIVITY

83. This table is a simple combination of Tables J and K. The index computed for each sector shows labour productivity in that sector as a percentage of average productivity for the whole economy. Comparisons of assumptions about productivity change over the period of the plan may be easily made within this table. The inverse of the productivity changes - in absolute currency values - recorded here are used as one of the factors in the analysis reported in Tables P, Q, R and S[1].

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[1] Tables N and O and Tables P, Q, R and S will be explained in the relevant sections of this chapter.

C. Supply effects on manpower estimates: an example of possibilities for substitution

84. A thorough empirical investigation of the effects of supply of various types of manpower upon the amount of a factor demanded would require considerable quantities of data on a comparable basis for many countries and for several economic and educational variables. This technical evaluation does not provide the proper arena for such a task, both because the data in the Reports themselves are not sufficient and because an evaluation is not the place for fundamental research. However, within the limits of the data available in the reports some empirical examples can be generated which give an idea of the possible dimensions of the problem. At the same time, the method used in these examples could be incorporated into the planning process itself as a stop-gap means of dealing with this problem; more basic research on this problem may allow a more sophisticated treatment at a later date.

85. In Chapter II, Section D, it was pointed out that there are two levels at which effects of supply on the conditions of demand present problems for educational planning. The empirical examples that have been worked out deal with only one of these levels, that concerning the relation between economic outputs and the occupational inputs. The second level of supply effects, that concerning the relation between occupations and the education associated with these occupations was not examined in these terms. For convenience, the problem of supply effects upon the demand for workers in various occupations will also be called the substitution problem - since supply conditions may be presumed to affect the number of workers demanded when technology is such that other inputs, such as capital, may be relatively easily substituted for various types of labour, or one type of labour for another, in response to differences in relative supplies of the various factors.

86. The first attempt to determine the importance of substitution possibilities was made by calculating what may be called occupational coefficients. These coefficients were computed for each occupation in each economic sector for the "base year" (the year used as the starting point for projections, near 1960). The coefficients are the number of workers in a particular occupational group in a sector per unit of sector output. These coefficients are derived from the basic tables simply by dividing each element of the table showing the distribution of employment by occupation and economic sector (Table H) by the appropriate sector output data in dollar terms from the table on GDP by sector of origin (Table K)[1].

87. The occupational coefficients are presented in Tables N and O[2].

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[1] In symbolic terms: L_{ij} - number of workers in occupation i in sector j, X_j - sector j contribution to GDP, l_{ij} - occupation coefficient for i in sector j, the $l_{ij} = L_{ij}/X_j$.

[2] A comparison at a fixed point in time of occupational coefficients rather than of the percentage distribution of occupations within a sector is more likely to lead to the discovery of any similarity in the structure of technological occupational requirements. This may be seen by supposing that requirement for, say, scientific and technical professional workers in manufacturing is quite fixed but that the requirement for unskilled workers in this sector is quite variable. If percentage distributions in manufacturing are compared, the differences in numbers of unskilled workers will disturb the percentages and obscure the underlying similarity of the requirements for scientific and technical professional workers. Occupational coefficients in one category are not statistically disturbed by the values in other categories and therefore similarities are allowed to emerge in comparisons.

88. If substitution possibilities were very limited then one would expect to find that the occupational coefficients were roughly similar among countries for a particular sector. If, for example, the occupational coefficients for Spain, Greece, Portugal and Italy are compared for technical workers in the manufacturing sector one would expect to find coefficients of approximately the same magnitude. This would mean that the nature of the technology was such that, regardless of the availability of such workers relative to the supply of capital or the supply of more or less skilled workers, the input of that type of labour per unit of output was not variable. This is the fixed occupational coefficient assumption which has been made in the MRP Reports - the possibility of alternative input patterns at any given point in time does not seem to have been considered (as far as can be judged from the texts of the Reports).

89. In Tables N and O, comparisons of occupational coefficients show a wide range of magnitude for almost any given occupation in any given sector, e.g. the coefficients for technical and related workers in manufacturing are roughly of the order 3, 5, 7 and 17 for the four countries for the "base year". This evidence must be interpreted with great care. The most that can be said is that, according to this evidence, there is no indication that the occupational input per unit of output is technologically fixed. All this comparison suggests is that the possibility that occupational input patterns may be varied at a given point in time should be considered.

90. The reasons why no stronger presumptions can be made on the basis of these data should be clearly shown. This can be accomplished by listing the various alternative factors which might be put forward as causes of the observed variation, among countries, in these coefficients. The most obvious are those relating to problems with the statistics themselves and, the most serious problem, that of comparability of the occupational classification[1]. This possibility is clearly relevant to these data since, as stated above, the classifications used in the Reports were not all exactly the same and, in some cases, the data had to be forced into the framework used for the comparison.

91. A second type of classificatory heterogeneity could arise from differences in the classifications of economic sectors. Since all Reports used roughly the same international classification, the forcing of the data in this direction was less severe[2]. However, the question of the heterogeneity of economic sectors can be maintained even if the classifications are exactly the same since the sector - at a fairly aggregate level such as this -

[1] This difficulty could arise even if every country was using exactly the same nominal classification, since census workers of different nationalities could well interpret the same classification differently, not to mention all the usual problems related to census data in general.

[2] A rough check was made of the data to see if there was any clear evidence of biases arising from differences in classification of either occupations or economic sectors. This was done by checking along a row or column of the matrix of coefficients to see wehther one country was consistently larger or smaller than the others. If, for example, technical workers in Italy were so defined that they included some of what were called sales workers in other countries, then one would expect Italian technical worker coefficients to be consistently larger than those of the other countries for all sectors. No evidence of bias appeared in this category, or in any other, except for the clerical and sales worker coefficients for Italy. These coefficients were lower for all sectors except transport and communications in the "base year" which may indicate some classification difficulties for this category for Italy. No other biases appeared when the tables were checked. However, this is only a rough sort of check for bias.

may contain quite significant differences in internal composition, e.g. in Italy the automobile industry is an important part of the manufacturing sector, whereas in Greece it does not exist. The question then remains whether more or less similarity in occupational coefficients would be found if the economic sectors were disaggregated into sub-sectors and the coefficients compared.

92. Variations in the coefficients could also arise because the output data were converted into common dollar terms by using exchange rates. This use of exchange rates as a conversion factor creates familiar problems. The variability introduced by this factor would be greater in those sectors which are not subject to the influences of international trade. It is more likely to introduce variability in the Transport and Communication sector than in Manufacturing or in sectors where differences exist among countries in the degree to which the price structure is affected by government action, e.g. agriculture[1].

93. Variations in the coefficients could also be caused by differences in the degree of utilization of capacity, i.e. recession could affect the degree of plant utilization and this could disguise underlying similarities in coefficients which would appear if all countries were working at full capacity. However, the magnitude of the differences in coefficients in most sectors seems to be too great to be due to this phenomenon alone.

94. Finally, variations could arise because the countries were working on different production functions. In order to minimize this possibility, the comparisons were made for approximately the same year in all the countries, thereby removing the effects of pure technological change which would appear if comparisons were made at different points in time (this is the normal procedure when trying to "identify" supply effects as differentiated from the effects of changes in the state of technical knowledge)[2]. It should be clearly

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[1] A casual examination of Tables N and O did not locate any evidence that this factor dominated as a cause of variability. Variation in coefficients did not seem significantly different in non-trade-affected as opposed to trade-affected sectors, or in agriculture.

[2] The existence of "trade secrets" and patent rights - to the extent these are observed internationally - and imperfections in the means of international communication on technological matters clearly limits the strict reality of this assumption. However, the fact that this is believed to be a reasonable generalization is indicated by its almost universal adoption in the literature on international economics, both theoretical and empirical. Numerous cases of the use of this assumption for theoretical purposes are cited in any general review of international trade theory: see, for instance, R. Caves, Trade and Economic Structure, Harvard University Press, Cambridge, 1960. This assumption is specifically adapted in several major empirical studies, e.g. K. Arrow, H. Chenery, B. Minhos and R. Solow "Capital - Labour Substitution and Economic Efficiency", Review of Economics and Statistics, Vol. XLIII. No. 3, August 1963, p. 226 and H. Chenery "Patterns of Industrial Growth", American Economic Review, Vol. L. No 4, September 1960, p. 626.

Naturally, when international or intra-national studies are made on the basis of a cross-section of very narrowly defined industries the lack of common accessibility to technological knowledge may be an important factor which must be allowed for - and, perhaps, appropriate information would be available at this level to make the allowance specific. Where the level of study is relatively aggregate (as it is in this work) there is no reason, given the present degree of understanding, to suppose that deviations from this assumption introduce any consistent bias.

It is important to understand that this assumption applies to technological knowledge in the purest, general sense. Clearly, the detailed knowledge and skills required to "embody" "known" technology in a productive process may be expensive to obtain and, thus, while a "best practice technique" may be known, it may not be "embodied" for economic reasons. This distinction between knowledge of "best-practice techniques" and their "embodiment" in the productive process is more fully discussed in Productivity and Technical Change, W.E.G. Salter, Cambridge University Press, 1960.

understood that differences in coefficients might appear even if the countries could be considered to be on the same production function - variations in this case would simply reflect the substitution of one type of input for another in response to relative supply availabilities. The importance of this distinction for planning purposes should be fully understood. If the differences are due to substitution effects then it is conceivable that at a point in time there are several different occupational patterns that are compatible with a given level of output; these various patterns could be obtained by varying the pattern of other inputs substituting for manpower or being substituted for by manpower. If this is the case, planners would have to take this into account in their plan formulation. If the variations are due to the fact that countries are on different production functions - as a result of "traditional" characteristics or other factors not strictly economic - then it will not be possible for a given country to obtain the alternative pattern of occupations without affecting the level of output. In this case fixed coefficient assumptions are justified and the observed differences in coefficients can be said to be due to factors outside the control or influence of the planning process - at least within the period of the plan.

95. Variations in the occupational coefficients could have arisen because of any of these factors - classification differences, the use of exchange rates for the output conversion factor, differences in the degree of utilization of capacity or differences in the production function upon which countries are operating - but none of these are supply effects. The possible causes of variability are listed so that the comparison made in this example is viewed with care and conclusions drawn from it are taken with the proper reservations. But, second and more importantly, they are listed in order to point up the many difficulties which manpower planners face in trying to draw conclusions about the occupational structure of various sectors by using international comparisons. As noted in the previous chapter, almost every country used some such international comparison to some extent in determining occupational structure estimates. All these comparisons were, theoretically, subject to all the complications listed above.

96. The objective in calculating and comparing occupational coefficients was to gain some insight into the possibility that occupational inputs were affected by the availability of such workers relative to the availability of other types of workers and other factors of production. Having listed all the other factors which might have caused the observed variations, it is necessary to note that the variation in the coefficients could have been due to the differences among countries in the supply of workers in various occupations[1]. The data did not provide any reason to reject this possibility, and, therefore, one must proceed on this basis that it is possible to vary occupational coefficients - subject to all the reservations listed and

[1] In the Greek Report, p. 12, it was suggested that the occupational structure was greatly affected by the size structure of the economic sector. An exact knowledge of the size structure of various sectors for various countries was not available. However, it can be argued that there is a good correlation between the size structure of a sector and the absolute size of the sector output. On the basis of this argument, an attempt was made to test the Greek hypothesis by drawing scatter diagrams plotting the occupational coefficients against the dollar value of sectoral output, for the various occupations and sectors. No uniform trend in the coefficients in relation to the size of sector could be observed in these graphs. Thus the variation in the coefficients did not seem to be explained by differences in absolute size.

to the possibility that more conclusive evidence on the question may appear eventually. If the possibility of substitution is accepted the next question is: how much difference could substitution make in the educational estimates that emerge from the Reports?

97. In order to obtain some idea of how much difference certain types of substitution might make in the projected education requirements, an empirical example was constructed using the Spanish projections as the basis for the exercise. Supply effects upon the occupational coefficients can be divided into two general categories. First, those which result in the substitution of other factors of production for labour, or vice-versa. This type of subsitution could result in variations among countries not only in occupational coefficients but also in the total labour productivity of a given sector. The second type of substitution is that between occupations within a sector, total labour productivity in the sector remaining constant, that is, the skill mix within the sector would vary but the total number of workers per unit of output in the sector would not vary[1].

98. The empirical example which was constructed was limited to the illustrations of the second, more limited, type of substitution. This was done because it is this type of substitution which is more directly relevant to the implicit assumptions made for the MRP Reports. As was noted in the previous chapter, it can be argued that the MRP assumptions were that a given level of productivity was associated with a particular, fixed set of occupational inputs, i.e. that substitution of the second type was non-existant, or so limited as to be unimportant[2].

99. The example amounted, simply, to tracing through the effects on the final educational estimates of the limited type of substitution. This was done by generating an alternative occupational distribution sector by sector for Spain in 1975 (holding sector total labour productivity constant) and then summoning up the occupational structure over all sectors. In order to give the example the maximum degree of realism, the alternative occupational structure was constructed on the basis of data drawn from the same type of tables for other countries for the base year. The alternative total occupational structure was then converted into educational requirements using the same conversion factors which were used in the Spanish Report to convert the estimated 1975 occupational structure into educational requirements for 1975[3]. In Table B the requirements resulting from this alternative occupational structure are compared with the requirements estimated in the Spanish Report.

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[1] In symbolic terms: the first type of substitution would result in variations of the l_{ij} and the L_j/X_j, where $L_j/X_j = {}_{i}l_{ij}$ where i are occupations and j economic sectors. This assumes that the countries are on the same production function in the sense that "total factor productivity" is the same but that there are differences in the labour productivity because different amounts of other factors are being used with labour. The second type of substitution would also result in variations in l_{ij} but L_j/X_j would be the same among countries.

[2] Although for the purposes of this study, the example was designed only to test the significance of the second more limited type of substitution the importance of the first, wider type substitution should not be forgotten. As noted in the previous chapter, this type of substitution can be important both because it can lead to biases in estimating procedures and because its existence would indicate a wider range of choice within which economic and educational policies could be determined.

[3] A step-by-step description of the procedure followed in producing the estimates for the effects of limited substitution is provided in Appendix II.

100. It is clear from the comparison of the alternative estimates with those of the Report itself that even the limited substitution illustrated in this hypothetical example can make a significant difference in the final estimates. Assuming that the range of possibilities was accurately reflected in the data for the base year upon which the estimates were constructed, the substitution would allow a 20 per cent reduction in the estimated requirements for higher education and a 10 per cent reduction in the estimated requirements of graduates from general secondary education, but these reductions would have to be offset by a 7 per cent increase in the estimated requirements for technical secondary graduates.

101. As mentioned in Chapter II, it should be noted that the choice among alternative estimates such as presented in the Table could be made according to several different criteria.

Lowest total cost would be one such criterion, but other criteria which had a higher social content or a longer time horizon of concern might be applied. For example, the alternative having greater higher-education requirements might be considered desirable because of the other social benefits which derive from having a larger percentage of the population with higher education. In this case the plan estimates are helpful in the sense that they suggest it will be possible to employ this greater percentage of higher education graduates within the framework of the projected economic plan, and thus, the danger of "intellectual unemployment" can to this extent be ruled out.

Table B. SPAIN: GRADUATE REQUIREMENTS 1960-1975

Comparison of Spanish graduate requirements based on Spain' s projected occupational distribution of the labour force, with graduate requirements based on an alternative occupational distribution of the labour force, allowing for limited substitution of labour

LEVEL OF EDUCATION	1 ESTIMATES OF GRADUATES REQUIRED ACCORDING TO SPANISH PROJECTIONS	2 ESTIMATES OF GRADUATES REQUIRED USING ALTERNATIVE OCCUPATIONAL DISTRIBUTION	% DIFFERENCE BETWEEN 1 AND 2
With Higher Education	243.4	192.9	+ 20.7
With Secondary Education ...	1,153.5	1,106.8	+ 4.0
general	(677.1)	(606.6)	(+ 10.4)
technical	(356.5)	(380.3)	(- 6.7)
Teacher Training	(119.9)	(119.9)[1]	-

NOTES: Estimates have been made for secondary and higher education only, as primary education is compulsory, and consequently no special provision is necessary on the basis of manpower requirements.

[1] Estimates have not been computed for primary teacher training, as primary education is compulsory, and hence requirements are based on demographic rather than manpower considerations.

102. The purpose of this example has been to show that realistic substitution possibilities can make important differences in the final educational estimates; the final educational estimates may change in fact, if the possible supply effects upon the number of workers demanded in various occupations. The example has also been put forward in an attempt to show how planners might trace through the implications of different assumptions about the occupational structure in various sectors. It is clear that given the present state of knowledge no single occupational structure can be said to be absolutely necessary for the attainment of specific economic outputs. As illustrated in the previous chapter, planners in the MRP countries used several different methods in arriving at occupational structure estimates. This suggests that any planner will be faced with a choice among several alternative estimates of the required occupational structure, based on the various methods of estimation. It is important that, before choosing anyone among the alternatives, planners should attempts to trace through to final education estimates. The example illustrates the way sensitivity analysis can provide insights which would aid the planner in making the "best" choice, or allow him to present decision-makers with a meaningful set of alternatives. Clearly this procedure does not deal with the fundamental question of the full importance of supply effects, but this question can be answered only by extensive basic research, and in the interim this procedure provides a stop-gap means of allowing for the possibilities of substitution.

D. Analysis of factors of change: the occupational distribution

103. The estimation of the occupational distribution of the labour force in the target year of the plan plays the central role in the methodology followed in five of the six MRP Reports. These occupational estimates are the key links between estimates of economic outputs and estimates of the educational requirements. A careful examination of the nature of these estimates must be, therefore, a basic element in any critical evaluation.

104. In undertaking such an examination, it is helpful to review briefly the process of arriving at these estimates as set out in the basic methodology[1]. According to this methodology the number of workers in any occupation group is determined, by definition (that is, this is a tautology, not a functional relationship)[2] by four factors:

a) the number in the occupation as a percentage of the employed labour force in each economic sector;

b) the productivity of labour (all labour in the sector) in each economic sector (or more exactly the number of workers per unit of output in the sector, i.e. the inverse of sectoral labour productivity);

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[1] H.S. Parnes, Op. cit.

[2] The tautological nature of this relationship is easily seen when expressed in symbolic terms:
GDP - Gross Domestic Product, $SGDP_i$ - Sector i contributed to GDP, L_i - total labour in sector i, L_{ij} = number in occupation j in sector i :

$$\begin{array}{lccccc} & & (a) & (b) & (c) & (d) \\ L_{ij} & = & \left(\frac{L_{ij}}{L_i}\right) & \left(\frac{L_i}{SGDP_i}\right) & \left(\frac{SGDP_i}{GDP}\right) & (GDP) \\ \text{or, } L_{ij} & = & L_{ij}\text{, a tautology.} & & & \end{array}$$

c) the percentage distribution of Gross Domestic Product among economic sectors;

d) the level of Gross Domestic Product.

If, for any year, these four factors are multiplied together for each sector and then summed over all sectors, the resultant will be the number of workers in that particular occupation in that particular year. It follows that a change in any one of these factors, all the others held constant, would change the total number of workers in the given occupation group. Over the period covered by the educational plan it may be expected that all four of these factors will change. The estimated change in the number of workers in the occupation over the period of the plan can be attributed to the estimated change in these four factors. Some of the factors will act to enlarge the number in the occupation, e.g. an increase in GDP; other factors will have the effect of reducing in the number in the occupation, e.g., a decrease in the occupation as a percentage of the labour force in some sectors. The actual estimated change in the numbers in the occupation over the period of the plan will be the resultant of the joint effect of these factors, some offsetting the others.

105. An examination of the nature of the occupation estimates simply amounts to asking: what was the relative importance of the four factors which determine the estimates? Two of the four factors can be related to two of the questions raised in the previous chapter. Factor b), the inverse of labour productivity, is obviously to be connected with the question of the affect of uncertainty of productivity estimates upon educational estimates. An indication of the relative importance of this factor in estimated change in the numbers in each occupation will indicate the seriousness of the problems raised by the likely inaccuracy of productivity estimates. Factor c), the sectoral distribution of GDP, is related to the question about the desirable degree of disaggregation. An indication of its relative importance in the estimates will shed some light on the degree to which this type of disaggregation is likely to improve estimates. Thus, in attempting to answer the question about the relative importance of the four factors which entered into the estimation of the occupational distribution of the labour force tentative steps are made toward answers to some of the basic questions which have been raised about the manpower requirements approach.

106. The data available for the examination of these questions are those already presented in the basic comparable tables and used in the previous empirical example. For three countries, Greece, Italy, and Spain, there are data giving occupational distribution by economic sector-data which have been made comparable both in terms of occupational classification and of the classification of economic sectors. There are also comparable data on the Gross Domestic Product by economic sector for both the "base year" and the "target year", Table K. From these tables values of the four factors related to the occupational distribution can be derived for both the "base year" and the "target year". Taking the difference in the numbers in each occupation in the "base year" as compared to that in the "target year" and the difference in each of the four factors over the period, changes in the factors and changes in the numbers in each occupation can be analyzed.

107. This analysis will indicate the relative importance of each of the four factors which determine the estimates of change in the occupational distribution for each of the three countries. Such an analysis showing which factors weighed most heavily in determining the estimates of occupational change can be useful in two ways. First, the results can be compared with those of similar analyses of historical data as a means of roughly checking the reasonableness of the planners' assumptions about the importance of the different elements of change. This type of comparison was carried out on a very limited basis, as will be described below. Secondly, such an analysis can be used by planners in the process of developing their plans, to get a clearer idea of what factors and assumptions are playing a major role in determining their final estimates of occupational change. An awareness of the sensitivity of their final estimates to their various assumptions would allow them to go back and more carefully examine the most important elements in their estimating process or to hedge their final estimates in view of the degree of uncertainty which dominates through the various assumed - or estimated - factors.

108. The Italian MRP Report has provided some historical data on the occupational distribution and the levels of GDP by economic sector. The same type of analysis of the relative importance of the four factors related to occupational change can be made on the basis of these data. As noted above, the results of this historical analysis can be compared with the analysis of the projected estimates of occupational change for the three countries. It is important, however, to be aware of the dangers inherent in such comparisons. Although possible reservations about the validity of such comparisons are carefully examined at a later point, it is worth noting the major problems here. The expected growth pattern of the countries over the period of the plan can be significantly different from the historical growth pattern observed in the country used for comparison. In addition, the degree and type of structural disequilibria, particularly in the occupational distribution of the labour force, may be quite different at the start of the plan period from the particular disequilibria which existed at the start of the historical period in the country used for comparison. These reservations will be more carefully examined when the results of the comparison are discussed below.

109. The technique used to relate the changes in the absolute numbers in each occupation to changes in each of the four factors is similar to the sensitivity analysis used in the previous empirical examples but is not, strictly speaking, the same. For convenience, this type of analysis may be called analysis of factors of change. The difference between the two types of analysis is that in sensitivity analysis one factor is varied and the effect on the final estimates is observed, whereas, in sources change analysis several factors have varied and portions of the variation in the final estimate, which has been observed, are attributed to each of the varying factors.

110. The fact that in the case where analysis of factors of change is used several multiplicative factors have varied leads to a technical complication[1]. With several factors

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[1] A more precise description of the method used in analysis of factors of change and a discussion of the technical problem is provided in Appendix III.

varying, an interaction of their effects occurs which cannot be strictly attributed to one factor or the other. More technically, as has been pointed out in the literature, to which references are provided in Appendix III, the analytical problem arises because the resultant change analyzed is a product of the four factors, whereas, in trying to attribute a portion of the variation to each of the factors an attempt is being made to convert the resultant change to a sum of four elements. It is, therefore, necessary to make an arbitrary decision about how to proportion the interaction elements among the four factors.

111. The results of the analysis of factors of change in each of the projections of changes in the occupational distribution and the analysis of the historical change for Italy are given in Tables P, Q, R and S[1]. Looking at each table individually, it may generally be said that two of the four factors seem to be considerably more important in influencing the size of change for each occupation, with the exception of technical workers. The factor which consistently weighs most heavily is the change in the level of GDP (factor d in the tables). The other large factor, which works in the opposite direction, is changes in the level of labour productivity in the various sectors (factor b in the tables). Generally, changes in the occupational distribution within each sector (factor a in the tables) are not very important - except in the case of technical workers. The sectoral distribution of GDP (factor c in the tables) is also not very important in most cases. This suggests that assumptions concerning the GDP and productivity growth rates in each sector have been to a large extent the determining factors in the formulation of the projected occupational estimates. A more forceful way of stating this conclusion is that a small error in the estimate of either the growth rate or the productivity change would entirely wipe out the effectiveness of extremely careful and accurate estimates of shifts in the occupational distribution within a sector or of the relative growth of the various economic sectors, i.e. careful disaggregation. On this evidence the productivity problem looms large.

112. The import for the aggregation problem of these results is only partial: the effort to disaggregate GDP into sectors, to the level carried out in the Reports, did not play a significant role in determining occupational estimates, but this by no means settles all the aggregation questions.

113. Several suggestions to future planners follow from these results. This type of analysis not only underlines the importance of the productivity problem, but also provides additional information which may help the planner to reduce the uncertainties introduced by undependable estimates of productivity change. This information is provided in the internal elements of the Tables. If these elements are examined for particular occupations, those sectors in which the productivity change assumptions played the largest part can be picked out and energy can be concentrated on improving these estimates[2]. The importance of the

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1. See Appendix V and for a methodological note on these tables, see Appendix III.

2. A quick survey of the tables with this point of view in mind brought out one particularly disturbing element. For many occupations assumptions about productivity change in the sector "government and other services" were very important. This is disturbing both because there is no evidence that estimates in this sector were made with special care and because the concept of productivity itself in this sector, where output measurements are largely input based, is rather vague.

growth of GDP as an element in determining the occupational distribution gives particular emphasis to the idea that alternative estimates of the occupational distribution related to different assumed rates of growth of GDP should be drawn up, at least in the planning process, even if not presented in the final plan document.

114. The analysis of the results for individual countries can be deepened when comparisons are made among countries and particularly when comparisons are made between the results for projections and those for the historical data. In undertaking such comparisons it is necessary to make, once again, important reservations about this type of analysis. The major reservation must be, of course, about the underlying comparability of the statistics. The problems of differences in the classifications of occupations and sectors and in the internal composition of the sectors, of the validity of exchange rate conversions mentioned with respect to the analysis in the previous section all apply to this analysis as well. The second type of reservation mentioned above concerns the significance of comparisons between the historical experience of one country and the planned change in another - or even the planned future change in the same country.

115. Some steps may be taken, however, to try to determine the extent of the seriousness of this second type of reservation. The comparisons to be made here are between the ten-year period 1951-1961 for Italy, the 15-year period 1960-1975 for Spain and 1961-1974 for Greece. This is suggestive of the limitations of the comparison in one direction. The GDP growth rate for Italy over the period 1951-1961 was 5.9 per cent[1] according to the MRP Report. The projected GDP growth rate on which the Spanish Report was based was 6 per cent and averaged 6.7 per cent over the plan period for Greece. These, at first, seem of roughly the same order of magnitude, but differences in long-term growth rates are much more significant than they look in simple growth rate numbers. For instance, one author[2] has estimated that with the present structure of the United States economy, in order to raise the growth rate over the twenty year period 1960 to 1980 by 0.1 percentage points it would be necessary to increase private net investment one-fourth above what it would otherwise be.

116. By comparing the percentage sector distribution of GDP at the beginning of the period analyzed - 1951 for Italy, 1960 for Spain and 1961 for Greece - the degree of similarity of the growth pattern can be appraised. In general the relative size of the sectors was quite similar and the growth pattern was also similar with the exception that at the beginning of the plan period, Italy had a higher percentage of GDP in manufacturing than had either Spain or Greece. At the end of the period, i.e. 1961 for Italy, 1974-1975 for Greece and Spain, manufacturing accounted for approximately the same percentage for Spain and Italy but Greece had still a significantly smaller percentage of output in manufacturing. The target year per capita GDP for Greece and Spain was estimated to be at a level roughly

1. Italy, op. cit., Table 1, p. 28.
2. Edward Denison, The Sources of Economic Growth in the United States, 1962, p. 277.

equivalent to the 1961 per capita GDP for Italy. These indicators of degrees of similarity and difference should be clearly kept in mind as the conclusions based on the comparison of the projections for Greece and Spain with the historical experience of Italy are made and weighed.

117. The results of the analysis of the change in the occupational distribution of the labour force in Italy from 1951 to 1961 (as presented in Table S) can be compared with the analyses of the projections (presented in Tables P, Q, R). The comparison shows that, in general terms, the conclusions drawn from the analyses of the projections are confirmed in the historical analysis. GDP growth (factor d) and sector productivity change (factor b) dominate the historical experience in Italy also - with, once again, the exception of the category of technical workers.

118. In more detailed terms, however, the comparison with the Italian experience suggests that the estimated required increase in technical workers for Spain and Greece is too small in relation to the growth of the labour force as a whole. An analysis of the factors determining the occupational change in this category seems to indicate that the influence of the shift in this occupation as a percentage of sector labour force (factor a in the tables) is somewhat under-rated in the Spanish and Greek projection - even though for Spain the importance of this factor in the estimates is high. Since both the Greek and Spanish Reports had already emphasized the importance of increasing technical workers, this finding seems to give added support to their concerns.

119. Weaker conclusions to be drawn from the comparisons of the Italian experience with the projections are that both Spain and Greece have probably over-estimated the required growth of clerical and sales workers and under-estimated the relative importance of occupational shift (factor a in the tables) in determining the change in scientific, technical and other professional workers[1].

120. The analysis of the data for 1951-1961 were also compared with those of the Italian projection data. There were slight differences in the relative importance of the four factors, but these differences seemed quite reasonable since the projections cover a period of further growth and expansion in the Italian economy.

121. The limitations of the conclusions based on the comparative analysis should once again be emphasized. The primary purpose of the comparisons made here is to illustrate the possible usefulness of such analysis of the factors of change as applied to historical data. A plea must be entered for a larger number of such analyses of the experience of a wide number of countries, for then conclusions could be accepted with greater confidence;

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[1] A further check for a difference in disequalibria in the occupational composition of the labour force in the beginning of the period of analysis - 1951 Italy, 1960 and 1961 for Greece and Spain - was made by comparing the percentage occupational distribution of the labour force in these years. The distribution was roughly similar except that Greece had a somewhat higher percentage of technical workers at the start of the period - this tends to weaken somewhat the conclusion that the growth in this category is under-estimated for Greece - and both Greece and Spain had higher percentages in clerical and sales workers - this strengthens the conclusion that they may have over-estimated the required growth in this category.

a larger number of such analyses would certainly enhance planners' understanding of the evolution of the occupational distribution of the labour force. By combining the historical analyses with analysis of their own tentative projections, planners will be better able to concentrate their attention on those points which give rise to the greatest uncertainties about the accuracy of the final estimates.

E. Empirical analysis of the impact of manpower requirements

122. At the beginning of Chapter II (Section B), it was pointed out that the basic question concerning the manpower requirements approach to educational planning was whether the manpower requirements calculated do in fact have a significant impact on the educational system. This section contains a description of the empirical analysis carried out in an attempt to provide some tentative answers to this question.

123. The impact of manpower requirements logically precedes the other questions which have been examined in this part of the paper. As pointed out in Chapter II, Section B, these other questions dealing with the reliability of estimates become relevant only if the impact is found to be significant. The impact problem has been left until this final section, however, because, being the most difficult to answer, it requires the most complex analysis. It is hoped that this more difficult analysis will be more readily comprehensible against the background of analyses which have already been described.

124. It is quite difficult to formulate an empirical example, based only on data in the Reports, that will provide a significant response to the question of the influence of manpower requirements on the educational system. There is no simple way to give a quantitative answer to the question: what would the educational system look like in the future if these specific manpower requirement estimates were ignored? The forces which would shape the educational system in the absence of the manpower requirements type of planning are too obscure, the future course of the educational system without such plans is too uncertain to be meaningfully predicted.

125. In the MRP Reports themselves two partial approaches to the impact question have been made. In the Greek Report two tables are presented comparing the estimated 1962-1974 graduate requirements for higher education and for middle technical and vocational education derived on the basis of the manpower requirements approach, with the number of graduates which would be produced over the period if first enrolments had been maintained at only the 1961-1962 level[1]. In the Italian Report the rate of growth of the educational system from 1951 to 1961 was extrapolated and compared to two alternative estimates of educational requirements: the first based upon what are called "the objectives of our study" - which seem to be based on desired educational reform - and the second the manpower requirements[2].

[1] Greece, op. cit., Tables 3 and 4, pp. 36-37.

[2] Several tables in the Report must be combined in order to make a direct comparison of these three estimates in terms of educational requirements. The tables are 29, 36, 40 and 41.

126. According to the comparisons carried out as described for each country, the impact of manpower requirements is quite significant. Neither of these comparisons is completely satisfactory however. The Greek comparison, holding enrolments constant, does not seem sufficiently realistic as it is to be expected that enrolments would at least keep pace with population growth. The Italian extrapolation of the 1951-1961 rates of change seems too remote from the underlying factors which might cause such a change to be useful as a standard of comparison. For instance, Yugoslavia managed a rapid increase in the relative size of higher education in the 1950-1960 period; if this trend were extrapolated and applied to the next period it would generate a supposed standard with an unreasonably high percentage in higher education. Extrapolations are distorted by the peculiarities of the recent past and, therefore, provide a rather unreliable standard for judgement.

127. In seeking a more definite answer to the question of the impact of manpower requirements, a somewhat different line of approach from that taken in the Italian and Greek Reports was adopted for the present study.

128. Educational requirements, as derived from those of manpower, are composed of three major elements: i) the education required to keep pace with the growth of the labour force as a whole; ii) the education required to allow for the necessary adjustment in the occupational distribution of that labour force and, iii) the education required because of changes in the kind of education associated with each occupation (the occupational-educational relationships discussed in Chapter II, Section F). In order to develop an empirical example relevant to the impact question, it was considered that the last two elements formed the basis of the manpower requirements approach, and that, therefore, the impact should be judged only by the measured effect to these two elements. As the labour force grows the "output" of the educational system must be increased if the average level of education attained by the labour force is not to decrease. That is, if the larger labour force is to have the same percentage distribution among education levels, there must be some growth in the output of the educational system. It is argued, for the purposes of this empirical example, that this element of growth, just sufficient to maintain the educational level of the labour force, should not be due to the impact of manpower requirements.

129. If this view is accepted, in order to measure the impact of manpower requirements, it is necessary to subtract from the final estimates of educational requirements, as derived in the Reports, that increase in educational output which would be just sufficient to keep the average educational attainments of the labour force at the level they were at the beginning of the period. The remaining estimated required growth in the system would be due only to the shift in the occupational distribution of the labour force and to changes in the estimated education associated with each occupation. This remainder would be the measure of the impact of manpower requirements.[1]

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[1] One weakness of this approach should be noted here. If the "social demand" for education, i.e. demand not associated with education required for productive objectives, is positively related to the growth in income, the method described will attribute the increase in education in the labour force due to this "non-productive, social demand" to the impact of manposer requirements. Fortunately, this shortcoming can be somewhat reduced by the second stage of analysis described. This point is more fully discussed later in the text.

130. It is important, however, to carry the analysis a stage further in order to show how much of the difference due to the impact of manpower requirements can be attributed only to the estimated shift in the occupational distribution and how much to estimates of the shift in the kind of education associated with each occupation, to get a clearer view of the nature of the impact.

131. Some very specific types of data are needed if the analyses outlined above are to be carried out. In particular, it is necessary to have good data on the education associated with each occupation group (this set of relations might be called the occupational educational matrix)[1]. The necessity for those types of data limited the applicability of the exercise to two examples: the projections for Spain and the historical data (1951-1961) for Italy[2]. Comparisons between the results of the analyses of these different data are possible, but their validity is limited by many of the factors bearing on comparisons which have been discussed in previous sections.

132. The empirical example based on the Spanish data for 1960 to 1975 has been taken first, since the data are more complete and the analysis could be fully carried out. The first stage was to calculate the total impact of manpower requirements in line with the approach described above. To do this, the estimate of the labour force in 1975 was taken from the Report. The percentage occupational distribution of the 1960 labour force was taken and applied to the 1975 estimate of the total labour force. This gave an estimate of what the numbers in each occupation would be if the labour force grew but its distribution among occupational groups remained the same as in 1960. For facility of reference, this calculated distribution will be referred to as 0*.

133. Now the numbers in each occupation, as represented by 0*, were broken down into categories showing the level of education attained. This was done by applying the same percentages as had been observed for this occupation in 1960. This gives an estimate of what the educational stock of the labour force would have to be in 1975 if the labour force grew as estimated but the occupational distribution and the education associated with each occupation did not change. For convenience, this stock will be referred to as estimate E*.

134. This estimate of the required stock, E*, could then be converted into an estimate of the total flow of graduates required between 1960 and 1975 - if this stock is to be attained by 1975 - in the same manner as was done in the Report[3]. This graduate flow will be referred to as G*.

135. The estimate derived in this manner, G*, is an estimate of the required flow of graduates if the labour force grows but there is no change in occupational distribution or

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[1] To ensure that readers have a clear picture of the type of data referred to here, a copy of the occupation-education table of relationships (matrix) for Spain for 1960 is reproduced as Table C.

[2] The specifics of the methods of calculation for this example are given in Appendix IV.

[3] This requires subtraction of the estimated survivors from the 1960 labour force, by educational level, and an allowance for the rates of participation in the labour force of various types of graduates. For specific details see Appendix IV.

Table C. DISTRIBUTION OF THE ACTIVE CIVILIAN POPULATION BY OCCUPATIONAL CATEGORIES AND EDUCATIONAL LEVELS SPAIN, 1960

	TOTAL (in thousands)	PERCENTAGE DISTRIBUTION					
		HIGHER LEVEL	SECONDARY LEVEL			PRIMARY LEVEL	ILLITERATE
			GENERAL	TECHNICAL	VOCATIONAL		
1. Scientific and technical professional workers ...	121.4	78.4	2.4	11.3	4.9	3.0	-
Architects, engineers, surveyors, physicists, chemists	75.9	68.7	3.6	16.7	6.3	4.6	
2. Other professional workers[1]	134.0	22.8	5.0	3.1	9.0	60.0	
3. Technical workers	79.7	13.4	10.3	12.5	16.8	47.0	-
4. Administrative, executive and managerial workers .	120.9	13.8	18.3	2.0	4.7	61.2	-
5. Clerical and sales workers	1,387.6	1.5	7.2	1.3	2.7	86.8	.6
6. Farmers, cattle-breeders and fishermen	4,630.5	0.1	0.2	.	.	84.3	15.4
7. Workers - skilled, semi-skilled, unskilled	•4,865.3	.	0.5	0.2	0.2	92.7	6.4
8. Total active civilian population[2]	11,484.4	1.7	1.7	0.5	1.6	85.5	9.0

1. Excluding the 145, 000 teachers.
2. Including the 145, 000 teachers.

SOURCE: Sample of 1% of the 1960 census, supplied by the National Institute of Statistics.

in the education associated with each occupation. This estimate may be subtracted from the estimate of graduate flow requirements for 1960 to 1975 provided in the Report. Call this estimate G^r. This difference ($G^r - G^*$) is taken to measure the impact of manpower requirements. This is because the Report estimates, G^r, include not only labour force growth, but also the estimated change in the occupational distribution and in the education associated with each occupation. In Table D, column 3 represents the absolute size of the manpower requirements impact ($G^r - G^*$); column 4 shows the impact of the manpower requirements as a percentage of the Report estimates of required graduate flows ($G^r - G^*)/G^r$. Clearly, according to this approach, the impact of manpower requirements is very important for the Spanish plan, since for higher education, it accounts for well over 50 per cent of the total requirements for graduates and for secondary education for over two-thirds of the total requirements.

136. This first stage of the analysis is another example of the application of sensitivity analysis. Key assumptions were changed (those regarding occupational distribution and the education associated with each occupation) and the sensitivity of the final estimates of graduate requirements to the differences in these assumptions was then traced through.

Table D. SPAIN: IMPACT OF MANPOWER REQUIREMENTS ON REQUIRED NUMBER OF GRADUATES, 1960-1975

In thousands

LEVEL OF EDUCATION OF REQUIRED GRADUATES	1 G^r = REPORT ESTIMATES GRADUATE REQUIREMENTS	2 G^* = GRADUATES REQUIRED TO KEEP PACE WITH LABOUR FORCE	3 $G^r - G^*$ = TOTAL IMPACT OF MANPOWER REQUIREMENTS	4 IMPACT REQUIREMENTS AS % OF TOTAL REQUIREMENTS
With higher education	243.4	103.6	139.8	57.4 %
With secondary education	1,153.5	312.5	841.0	72.9 %
General	(677.1)	(51.4)	(625.7)	(92.4)%
Technical	(356.5)	(115.5)	(241.0)	(67.6)%
Teacher training ...	(119.9)	(145.6)	(-25.7)	(-21.4)%

G^r = The projected requirement of graduates by Spain from 1960-1975. This involves Labour Force growth to the projected 1975 level; occupational distribution of the Labour Force at the projected 1975 level; and education associated with each occupation at the projected 1975 level.

G^* = Graduate Requirements assuming only changes in the Labour Force. This involves Labour Force growth to the projected 1975 level; occupational distribution of the Labour Force in the same proportion as existed in the 1960 Labour Force, and education associated with each occupation in the same proportion as existed in the 1960 Labour Force.

$G^r - G^*$ = Total Impact of manpower assumptions on graduate requirements. This gives the number of graduates required because of changes in the occupational structure of the Labour Force, and the requirements due to changes in the education associated with each occupation, and the interaction of these two factors.

$\frac{G^r - G^*}{G^r}$ = Per cent of total requirements due to manpower requirements.

NOTE: Estimates have been made for secondary and higher education only, as primary education is compulsory, and consequently no special provision is necessary on the basis of manpower requirements.

137. The second stage of the analysis involved an attempt to determine how much of the difference due to the impact of manpower requirements could be attributed to each of the two elements which make up that impact, i.e., the estimated shift in the occupational distribution and the estimated change in the education associated with each occupation. To do this two more sets of estimates of graduate flow requirements were made, each reflecting a different set of assumptions. One set of estimates was made on the assumption that the labour force grew to the estimated 1975 level and the occupational distribution shifted to the percentage distribution estimated in the Report for 1975, but the education associated with each occupation was held at the level observed in 1960. This set of estimates was derived in a manner similar to that described for the first stage of the analysis, with the exception of the difference in the assumed percentage distribution of occupations. The full description of the derivation need not be repeated here. These estimates can be called, for convenience, G^+. Now taking the difference between these estimates G^+, including the allowance for occupational shift, and those derived for the first stage, G^*, which are based on the assumption of no occupational shift, a measure is obtained of the portion of the impact which can be attributed to the estimated occupational shift ($G^+ - G^*$). These values for each education level are reported in column 3, Table E.

138. The second set of estimates was derived by assuming that the labour force grew to the estimated 1975 level, the percentage occupational distribution remained as it was in 1960, but the education associated with each occupation shifted to the 1975 levels estimated in the Report. This set of estimates was also derived in a manner similar to that described for the first stage of the analysis, with the exception of the difference in the assumed education associated with each occupation. Once again, a detailed description of this derivation is not necessary. These estimates can be called, for convenience, G''. Taking the difference between these estimates, G'', including the allowance for the shift in the education associated with each occupation, and those derived for the first stage G^*, which are based on the assumption of no shift in education associated with each occupation, a measure is obtained of the portion of the impact which can be attributed only to the estimated change in the education associated with each occupation ($G'' - G^*$). These values for each education level are reported in column 4, Table E.

139. Now it is important to note that a portion of the impact has been attributed to each factor but the two portions do not add up to the total values of the impact for each level. The difference between the total impact and the sum of the portions which can be attributed to each factor singly is due to the interaction between the two factors[1]. The interaction element is reported in column 5, Table E. For some levels of education the interaction element is relatively unimportant, for others it is larger than the portion attributed to either of the factors singly.

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[1] This problem should be familiar to the reader. It was mentioned in Section D of this chapter and is more fully explained in Appendix III. It is now clear that the analysis of this second stage is a form of what has been called analysis of sources of change.

Table E. SPAIN: RELATIVE IMPORTANCE OF OCCUPATIONAL AND EDUCATIONAL ASSUMPTIONS IN DETERMINING TOTAL IMPACT

In thousands

LEVEL OF EDUCATION OF REQUIRED GRADUATES	1 G^{+}	2 G^{-}	3 DUE TO OCCUPATIONAL ASSUMPTIONS ALONE $G^{+} - G^{*}$	4 DUE TO EDUCATIONAL ASSUMPTIONS ALONE $G^{-} - G^{*}$	5 INTERACTION	6 TOTAL IMPACT
With higher education ...	170.3	177.0	66.7	73.4	- 0.3	139.8
With secondary education ...	509.6	694.4	197.1	381.9	+ 262.0	841.0
general	(158.9)	(433.4)	(107.5)	(382.0)	+(136.2)	(625.7)
technical	(205.1)	(141.1)	(89.6)	(25.6)	+(125.8)	(241.0)
teacher training	(145.6)	(119.9)	-	(-25.7)	-	(-25.7)

G^{+} = Graduate Requirements assuming no change in the education associated with each occupation. This involves Labour Force growth to the projected 1975 level: occupational distribution of the Labour Force at the projected 1975 level, and the education associated with each occupation in the same proportion as existed in 1960.

G^{-} = Graduate Requirements assuming no change in the occupational distribution of the Labour Force. This involves Labour Force growth to the projected 1975 level: occupational distribution of the Labour Force in the same proportion as existed in 1960: and the education associated with each occupation at the projected 1975 level.

$G^{+}-G^{*}$ = Portion of total impact due to occupational assumptions alone. (For definition of G^{*}, see previous table.)

$G^{-}-G^{*}$ = Portion of total impact due to educational assumptions alone.

Interaction = Portion of total impact due to interaction of occupational and educational assumptions.
= $(G^{t}-G^{-}) - (G^{+}-G^{*})$.

NOTE: Estimates have been made for secondary and higher education only, as primary education is compulsory, and consequently no special provision is necessary on the basis of manpower requirements.

140. The results of the second stage of the analysis of the Spanish projections can now be evaluated, but they must be evaluated level by level. For higher education the assumptions about occupational shift and about shift in education associated with each occupation were both fairly important in determining the size of the impact; the assumed shift in education, associated with each occupation, was slightly more important. The interaction element was negligible.

141. For secondary education as a whole, the shift in education associated with each occupation was relatively more important, but the interaction element was quite significant. For secondary general education, the shift in assumptions about the education associated with each occupation was the most important factor (this is shown by the fact that, although the interaction element was large, even if it were to be lumped together with the portion attributed to occupational shift estimates, the sum of these two elements would not approach the portion due to shift in education associated with each occupation). For technical secondary education, the interaction element heavily outweighs the portion attributed to either of the factors alone. The impact of manpower requirements in the case of technical secondary

education was generated largely by the fact that shifts in both factors were assumed, whereas a shift in either one of them alone would have produced a much smaller impact.

142. This evaluation shows that the assumed shift in education associated with each occupation played a very important part in determining the extent of the impact of manpower requirements in the Spanish projections. This fact must be viewed in the light of the discussion in Chapter II, Section F, on the lack of information concerning occupational-educational relationships. As noted in that section, this element is the weakest link in the whole estimation process, in terms of the present state of knowledge. This should not be taken to imply that the Spanish estimates of the required shift in education associated with each occupation are not reasonable. It is simply necessary to point out the importance of these assumptions; the final estimates are extremely sensitive to these assumed shifts. If, in the process of formulating estimates of educational requirements based on manpower requirements this type of analysis were carried out, it would allow planners to concentrate more effort on those assumptions, (in this case assumed shifts in occupational-educational relationships) which are important in the determination of their final estimates. This deeper awareness of the nature of the impact of their manpower requirements would allow them to draw their planning inferences with a firm eye on the relative uncertainties in the different elements making up the plan. The importance of the assumed change in the occupational-educational relationships in the projections for Spain suggests a further question. If the shift in occupational-educational requirements is clearly the major element determining the size of the impact of manpower requirements, as measured here, what implications does this have for the entire manpower requirements approach? A digression will be made here to examine this question because it provides further insight and gives rise to suggestions for important research.

143. If it were found, on examining a large number of historical examples, that change in the labour force could be largely attributed to a shift in the occupational-educational relationships rather than in the occupational distribution, basic doubts would be raised about the manpower requirements approach as presently practised. Such a finding could be viewed in two general ways. First, the shift in the educational stock in the labour force could be largely unrelated to the production requirements of the economy. That is, most of the education could be acquired for the purposes which have often been lumped under the heading of "social demand". Such demands could be related to the growth of income - this has sometimes been called the "consumption" demand for education - or they could be related to non-economic developments. When the change in the educational stock in the labour force is analyzed according to the approach used in this section, growth in educational stock due to "social demand" factors would be included in the measured impact of manpower requirements in the first stage of the analysis. To this extent this approach could lead to mistaken inference - more than the minimum educational requirements being attributed to manpower requirements. However, at the second stage of analysis such "social demand" growth in the educational stock in the labour force would be clearly attributed to the shift in the occupational-educational relationship. Thus, the second stage

of the analysis provides a rough check for dominance of this type of demand. When dominance of the occupational-educational shift appears in the second stage of analysis, care must be taken about calling the impact measured in the first stage that due to manpower requirements.

144. One general way of viewing such a dominance then, is to consider the possibility that it is due to "social demand" phenomena. The second general view is to consider that there is a connection between the growing, changing productive processes and the changing occupational-educational relationships, i.e. that the changing productive processes require such a shift in the education associated with each occupation. If this were the case, then the measured impact could still be said to be due to manpower requirements. However, this dominance of the shift of occupational-educational relationships would still cast a serious doubt on the present methods of deriving education requirements from manpower requirements estimates. The present methods focus closely on the occupational distribution, but evidence of dominance of the shift in occupational-educational relationships would suggest that even when the occupational distribution is accurately estimated, only a small portion of the total relationship between economic processes and the corresponding education required has been pinned down. In this case, centering a large part of the planning effort on estimating the occupational distribution would not be very wise. A search for other factors relating economic processes to education required would have to be the focus of the main planning effort.

145. While for a digression, this discussion has been rather long, it has been only a cursory examination of these issues. Even this brief examination shows there is an immediate need for a further analysis of the historical data of many countries using a method similar to those outlined in this section[1].

146. Fortunately, this digression can be followed by a description of an empirical example which takes a partial first step in the direction just suggested.

147. The data for Italy for 1951-1961 contained in the Italian Report permitted a first stage analysis similar to that carried out for Spain. The second stage could be only partially carried out for Italy because of data limitations.

148. The impact of manpower requirements on the Italian educational system from 1951-1961 was measured as described above for Spain, except that educational stocks were used rather than graduate flows, the information for conversion to flows not being readily available. This makes no difference in the evaluation of the results, however, since the conversion to flows simply requires the multiplication by certain constants (as explained in

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[1] Evidence for the U.S. experience suggest dominance of the shift in occupational-educational relationship, see J. Folger and C. Nam, "Trends in Education in relation to Occupational Structure" Sociology of Education, Vol. 38, 1964. The examination of the Italian data below suggests the contrary. Clearly, the U.S. experience could reflect its level of economic and educational development - perhaps the "social demand" elements are responsible in this case. A wider sample of countries must be analyzed if the differences in evidence are to be fully understood.

Appendix II). First a set of estimates was obtained allowing for the labour force growth to the 1961 level but keeping the 1951 occupational distribution and the 1951 occupational-educational distribution of the labour force. These estimates may be called E^* (since they are education stocks rather than graduate flows). These estimates show what the stock of education would have been in 1961 if the labour force had grown to the 1961 level but there had been no change in the percentage distribution of occupations or the education associated with each occupation. Taking the difference between these stock estimates, E^*, and the actual educational stock in the labour force in 1961, E^r, a measure of the impact of the manpower requirements upon the educational "output" is obtained (E^r-E^*). These results are reported in column 3, Table F. In column 4, Table F the impact is shown as a percentage of the actual change in the educational stock from 1951 to 1961 (E^r-E^*/E^r-E^{51}, where E^{51} is the educational stock in the labour force in 1951). The impact on this evidence was very significant.

149. Only a partial comparison with Spain was possible for the second stage of the analysis of the Italian data for 1951-1961, since no information was available on the relation of education to occupation in 1951. With the information to hand it was possible to calculate that portion of the impact which could be attributed to the shift in the education associated with each occupation. The portion attributed to shift in the occupational distribution could not be separated from the interaction element[1].

Table F. ITALY: IMPACT OF MANPOWER CHANGES ON NUMBER OF GRADUATES, 1951-1961

In thousands

LEVEL OF EDUCATION OF GRADUATES	1 E^r = STOCK OF GRADUATES 1961	2 E^* = STOCK IF GROWTH ONLY KEPT PACE WITH LABOUR FORCE GROWTH	3 E^r-E^* TOTAL IMPACT OF MANPOWER CHANGES	4 IMPACT AS % OF TOTAL CHANGE[1]
Higher education	446.0	388.0	+58.0	50.9
Secondary education	2,988.0	1,920.0	+1,068.0	82.3
1st cycle	(1,920.0)	(1,183.0)	+(737.0)	(83.8)
2nd cycle	(1,068.0)	(737.0)	+(331.0)	(79.2)

Er = Number of graduates of secondary and higher education in the Labour Force in 1961.

E^* = Number of graduates of secondary and higher education in the Labour Force in 1961, if no change had taken place in the occupational distribution of the Labour Force, and if the education associated with each occupation had remained in the same proportion as existed in 1951. This allows for growth of the Labour Force to 1961 level.

E^r-E^* = Change in the stock of graduates of secondary and higher education between 1951 and 1961 due to manpower changes.

1. Total change is the actual difference between the number of graduates of secondary and higher education in the Labour Force in 1961 and 1951.

NOTE: Estimates have been made for secondary and higher education only, as primary education is compulsory, and consequently no special provision is necessary on the basis of manpower requirements.

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[1] In view of the previous sentence the ability to calculate only the portion attributable to the shift in education associated with each occupation alone may seem curious. The reasons for this are presented in Appendix IV.

150. The results of this partial second stage analysis are reported in Table G. The total impact ($E^r - E^*$) is reported in column 2 and the portion attributed to the shift in education associated with each occupation ($E^{''} - E^*$) is reported in column 1. These results show that for Italy 1951-1961, the portion of the impact that can be attributed to the shift in the education associated with each occupation is much less significant in relation to the total impact than for the Spanish projections[1].

151. Since the interaction element cannot be separated from the portion attributable to occupational shift, the implications drawn from this comparison of partial results must be very limited. The result for Spain for technical secondary education provides sufficient warning that the interaction element can be quite significant indeed. Thus, again, the temptation to conclude that the major portion of the impact can be attributed to occupational shift alone must be resisted.

152. The results of the second stage of the analysis of the historical data for Italy are encouraging from the point of view of the present practice of deriving educational requirements from estimated manpower requirements. This is because (as discussed in the digression in pp. 54-55) a finding that a large portion could be attributed to the shift in education associated with occupation alone would raise serious questions about the manpower requirements methods currently used. Since in the period 1951-1961 for Italy, as

Table G. ITALY: RELATIVE IMPORTANCE OF EDUCATIONAL ASSUMPTIONS IN DETERMINING TOTAL IMPACT

LEVEL OF EDUCATION OF GRADUATES	1 $E^{''} - E^*$ DUE TO EDUCATION CHANGES	TOTAL IMPACT $E^r - E^*$
Higher education	- 59.0	+ 58.0
Secondary education	+ 276.0	+1,068.0
1st cycle	(+ 234.0)	(+ 737.0)
2nd cycle	(+ 42.0)	(+ 331.0)

$E^{''} - E^*$ Gives the difference between the stock of graduates in 1961, had no change in the occupational distribution of the Labour Force taken place, (this assumes 1961 Labour Force, with 1961 education associated with each occupation, but 1951 occupational distribution of the Labour Force) and the minimum number of graduates required to keep pace with Labour Force growth.

1. It is not possible to separate the interaction and occupational shift factors, as was done in the case of Spain (see previous tables).

NOTE: Estimates have been made for secondary and higher education only, as primary education is compulsory, and consequently no special provision is necessary on the basis of manpower requirements.

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[1] The result for higher education of a negative value for the portion due to the shift in education associated with each occupation may seem strange. One interpretation of this result would be: the pressure of substained growth raised the numbers in high level occupation categories rapidly and thus drew into this group a large portion having lower educational qualifications than those who were already in these occupations. This, of course, reflects back upon the substitution questions raised in Chapter II (particularly, p. 23).

represented by the Report data, the shift in education associated with each occupation was not a dominant element, the problems discussed in the digression may not be important. However, it would be dangerous to view this evidence as conclusive on these issues. A much wider sample of historical data for several countries must be analyzed before these problems can be explicitly dealt with.

IV

A REVIEW OF THE RESULTS AND FURTHER CONCLUSIONS

153. The empirical analyses carried out in the previous chapter were rather rudimentary and, therefore, they provide only tentative or partial answers to the questions raised at the end of Chapter II. Their rudimentary nature was dictated by the limitations of the data available. However, for the first fime, through the pioneering efforts of those involved in the MRP, it was possible to attempt to put into quantitative dimensions the arguments which had heretofore been the subject of purely theoretical squabbles.

A. *A Review of the Results*

154. Having completed the description of the empirical examples, it is possible to review the results of the analysis in terms of the questions which were raised earlier.

a) As measured in this study, the impact of manpower requirements upon the educational system is likely to be very significant. That is, even after allowance is made for the growth in the output of the educational system which would be necessary to keep pace with the growth in the labour force (in order to keep the "average" level of educational attainment in the force constant), the impact of changes in the occupational distribution of the labour force and changes in the education associated with each occupation would require significant shifts in the output of the educational system. This finding was based both on the analysis of projected changes in the economy, as estimated in the MRP Reports, and on an analysis of the actual changes in Italy from 1951 to 1961. On this evidence, the direction of the manpower requirements approach - which focuses on the careful calculation of shifts in occupational distribution and in education associated with each occupation - seems reasonable. However, as the other results of the empirical studies indicate, much work remains to be done to improve the reliability and sophistication of the manpower requirements methods.

b) The problems raised by uncertainties about productivity change (technological change) loom quite large. The problem of estimating productivity change is one which plagues general economic planning as well as manpower and educational planning (but, it should be noted, this has not inhibited world-wide use of economic plans). In this sense, the burden of this problem is widely shared. However, the analysis of the sources of change in the occupational structure showed that productivity estimates played a major role in the MRP projections, in determining the overall occupational structure estimates (and that the estimates of GDP growth were equally important). Thus, uncertainty about productivity change is largely transformed into uncertainty about the occupational structure. A more striking way of putting this is that small errors in estimates of productivity change (or of GDP growth) would be likely to wipe out the effectiveness of extremely careful and accurate estimates of shifts in the occupational distribution within a sector or of the relative growth of various sectors, i.e., careful disaggregation of GDP. The importance of this productivity change element in occupational shift was confirmed both in the MRP projections and in the analysis of the historical data for Italy.

c) The results of the empirical investigations suggest that occupational input coefficients at a given point in time are variable, i.e. that substitution possibilities exist, so that the amount of various types of labour demanded can be adjusted in response to changes in relative supply. In addition, an empirical example, based on MRP data, was constructed to illustrate the possible degree to which substitution among occupations - even with total sectoral labour productivity held constant - could have an effect on the final estimates of educational requirements; the example indicated that these effects could be substantial. Thus, on this limited evidence, substitution possibilities both exist and can be important in their effects on manpower requirements estimates. The existence of a range of substitution and, therefore, the possibilities of supply effects on the amount of manpower demanded, can be significant because, unless carefully considered, supply effects can introduce unsuspected biases in the procedures used to estimate manpower requirements. Substitution is also important because it indicates the possibility of a range of choice among alternative patterns of manpower inputs which would be consistent with a given set of economic output targets.

d) The question of the desirable degree of aggregation to be used in manpower requirements estimation remains open. The analysis of the MRP Reports suggested that disaggregation of GDP to economic sectors did not contribute significantly to the estimates of occupational distribution. This does not mean that in every case disaggregation will not be useful. In fact, it can be argued that the results suggest that the pay-off from disaggregation has not yet been realised. However, it should be remembered that there is no guarantee that the effort to disaggregate data will yield better estimates than could be obtained with aggregate information.

e) The most serious problem which emerges from the empirical analyses is that which results from the lack of knowledge about the education associated with each occupation. It was shown that for one of the MRP countries, estimated changes in the occupational-educational relationships were of over-riding importance in the determination of the final estimates of educational requirements. Because of the lack of knowledge about these relationships, estimates can, for the most part, be based only upon assumptions about their nature - this is certainly the weakest link in the manpower requirements estimating procedures. One way of reducing the sensitivity of final results to these assumptions has recently been suggested by a group formed to create similar educational plans for Ireland.

They proposed that rather than converting occupational estimates into educational equivalents for the entire labour force in the target year, the conversion to educational requirements should be applied only to the estimated new inflow of workers into the labour force over the period of the plan[1].

155. In order to attempt to determine the potential importance of the weakness in the manpower estimating procedure arising from ignorance of occupational-educational relationships, historical data were considered. Analysis of the data for Italy for 1951-1961 showed that the shift in education associated with occupation was not nearly so important in determining the total shift of the educational stock in the labour force as had been suggested by the analysis of projections for the MRP countries. On the other hand, a published analysis of data for the United States for 1940-1960 provided results which were quite similar to those which emerged from the analysis of the MRP country projections. Thus, the historical data do not, at this stage, yield any definitive insight into the likely importance of this weakness in the manpower requirements approach.

B. *Further Conclusions*

156. Having restated the results which bear specifically on the questions raised in Chapter II, there are further conclusions and suggestions which can be put forward on the basis of this study.

a) As noted in the text, because of limitations of the data, the evidence of substitution possibilities can be viewed only as indicative and not conclusive. It follows that more basic research, using better data and more sophisticated techniques, is required in order to establish on a more scientific basis the existence and range of substitution possibilities. In addition, as suggested above, the existence of substitution at a given point in time indicates that a range of alternatives would be available among which it would be necessary to choose. Such choices could follow either of two lines: the range of alternatives could be presented as such to policy-makers and they could choose according to their own criteria or planning criteria could be anunciated a priori. This suggests further studies of the possible criteria which might be applied in such situations, to the choice amongst alternative manpower-education requirements (all compatible with the given economic targets). One such criteria would be educational cost minimization; this possibility indicates the importance of further studies of the factors affecting educational costs.

b) The problem of productivity change has been shown to affect the skill mix of the labour force but it is also helpful to consider the reverse possibility, i.e., that the availability of skilled labour can affect the level of productivity obtained. This suggests that it is worth considering whether the process of estimating manpower requirements should not be integrated more fully into the total economic planning process. If there is, as one would suppose, some sort of relation between the skill mix of labour and productivity, and if, in addition, there is a range of substitution alternatives, then the planning of economic outputs should take into account the affects of alternative skill mixes on productivity and output and the relative costs, in terms of educational expenditure, of such alternatives.

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[1] For details see M. O'Donoghue, "The Manpower/Educational Activities of the Irish EIP Team", OECD, 1965 (to be published shortly in Manpower Forecasting in Educational Planning).

c) The sophistication in methods just suggested will require more data and more research. Until such research is forth-coming educational strategy should be formulated with the uncertainties engendered by technological change clearly in mind. For this reason, objectives of labour force flexibility might, for example, receive more stress in the planning of educational structure and content. Certainly manpower estimates should be presented in a way which reflects to some degree these underlying uncertainties. Manpower requirements estimates which conceal these uncertainties, by presenting single value estimates of requirements rather than ranges or alternatives, may do great disservice to formulators of educational policy.

d) It is clear that since the ignorance of occupational-educational relationships is the weakest part of the manpower requirements approach, further studies of these relationships have a high priority. This necessity is underlined by the fact that the analysis of historical data in this study provided somewhat contradictory results and this contradiction can only be cleared up when more such analyses have been completed[1]. As noted in Chapter III, the question about the relative role of the shift in education associated with each occupation in determining change in the educational stock in the labour force is of basic importance to the strength of current procedures. A dominance of this type of shift could mean that current procedures produce overestimates of manpower requirements by inadvertently including what has been called "social demand". Alternatively as explained in Chapter III, dominance of this type of shift could mean that current procedures are likely to miss the more important economic-educational relationships.

e) The usefulness of sensitivity analysis and the analysis of sources of change as tools in manpower and educational planning was demonstrated in several places in this study. These methods allow planners to realistically evaluate their estimates in light of the uncertainties of various elements of the estimating procedure. The methods can also be used to work out various alternatives within the plan so that a set of options can be presented to decision-makers. Finally, carrying out analysis, using these methods in the process of developping plans will help planners to review the development of their estimates. Usually, in planning, estimates are developed sequentially. There is, therefore, a need at various stages to reconsider the structure of the plan as a resultant of the simultaneous variation of the sequentially developed estimates. In planning, where the view is necessarily forward, the importance of looking back at the nature of the planning ground which has been covered is often neglected. An evaluation of methods, by its nature, leads to a re-emphasis of the importance of this backward glance. In sum, the methods of sensitivity analysis and analysis of sources of change allow planners to understand more fully the nature of the plans they develop and allow them to develop plans which more frankly represent the underlying uncertainties of their analysis.

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[1] For some first steps in this direction see Raul Traitenberg, "The Change in the Educational Content of the Labour Force", OECD, 1965, mimeo.

f) It follows from the results of this evaluation that there is a great need to follow-up projections of the MRP type in two ways. First, at the same time that attempts are made to implement plans, it is desirable that further data should be systematically collected and a means provided to continually "correct" the plan projections in light of the newly accumulated evidence. Second, it is important that follow-up studies be made which analyze in detail the actual development of the economy and the educational system and compare them with the developments estimated in the plan projections. Only with this type of basic research can the methods of estimating manpower requirements become more sophisticated and effective. This is certainly the way to gain even greater benefits from the MRP experience.

V

A PERSPECTIVE ON EDUCATIONAL PLANNING AND THE MANPOWER REQUIREMENTS APPROACH

157. It is now important to attempt to place the concentrated analysis of technical issues, reported in the previous chapters, in a more general perspective.

158. A statement of views on educational planning cannot spring from a study of the MRP experience alone. It must be based upon a broader, accumulated experience in educational planning in general. Thus the perspective suggested below derives from the wider range of OECD experience in this field, embracing the MRP, but extending beyond it as well.

159. In the past few years there has been a continuing controversy about various "approaches" to educational planning. In reviewing the arguments over which "approach" to educational planning is the "right" one, it becomes clear that when one views the educational system as a whole, and, more generally, the educational complex as an element within the overall social and economic system, all of these "approaches" fit together within the logic of the total system. The conflict among "approaches" arises only because there is a scarcity of resources which can be applied to planning and to research and therefore priorities must be established; it must be decided which "approach" will be investigated in depth and utilized and this, in turn, leads to arguments about which is most likely to yield immediate, pragmatic results for policy making. The decision as to which line to take will be influenced by the particular characteristics of a country, such as the type of data available, the level of economic development, and the current policy context and institutions. Thus, it is not surprising that, in the past, different approaches have been favoured in different countries.

160. As experience in educational planning and research is accumulated, however, the priorities for further investigation change, both because some avenues have been adequately explored and because in the process of exploration a more complete understanding of the critical points of the system has been obtained. It can be argued that, regardless of the approach initially favoured by various individuals, the experience has evolved in such a way that there can be general agreement on the current priorities for further planning and research effort. This is simply another way of saying that the underlying logic of the system is beginning to emerge and to exert its pressure on the configuration of investigations.

161. These generalizations need to be spelled out more fully[1]. It has become evident that at the center of educational planning and research there must be a clear picture of how the educational system operates - in current parlance, a "model" of the educational system. This picture should illustrate the quantitative flows into and out of the educational system - these flows would involve pupils, teachers, facilities and materials, finance. But ideally, if it is to be useful, such a picture, or model, should include or be complemented by an indication of the structure of decision-making within the system, which influences these quantitative flows.

162. Such a picture, or model, is essential for educational planning no matter which "approach" one starts from. Clearly, if what has been called the "social demand"[2] approach is the starting point, this model of the system is a requisite both for isolating the elements of "social demand" and for working out the full implications, in terms of the structure of enrollments, teacher force, etc. of the anticipated final demands. It has also been pointed out[3] that if one starts from the "manpower requirements" point, the result of the work is an estimated set of final education needs for which it is still necessary to work out the enrollment, teaching force and other structural implications. This will require the use of a system model for education. Another, slightly different, approach has been called "social objectives" and one of the difficulties this approach has encountered is that it has proved difficult to supply quantitative correlatives for some of the "objectives" which have been suggested. It can be argued that the existence of a quantitative model of the educational system will facilitate the search for quantitative expressions of "social objectives", since various interpretations of such objectives (e.g. "equalization of opportunity") can be worked out in terms of such a model. Thus, further work to construct and improve this picture of the educational system is a major priority from all points of view. Countries are at various stages of development in this work and the OECD is attempting to encourage such work through its programme of Operations Research and Systems Analysis in Education.

163. One of the elements of the picture of the educational system must be the specification of the direction which graduates take upon leaving the system. Since most graduates enter the labour market and since an individual's working environment plays such a major part in influencing his social role, some projection of the manpower situation is essential to any approach to educational planning. The need for investigation of the link between the educational system and the economy is necessary whether one begins with the premise that individual choice should be given maximum consideration in shaping the educational system or with the premise that the educational system must be shaped to meet the exigencies of economic growth. It is possible either to look upon the lack of the proper education in the labour force as the factor which might constrain economic growth or to look upon the lack

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[1] The structure of the following arguments is roughly based on Chapter IV of the Handbook on Statistical Needs for Educational Investment Planning, OECD, 1966.

[2] This has also been called the "cultural approach" and the "demand for places approach". For examples see: Parnes, op. cit., Chapter V; R. Ruiter "Manpower Forecasts and Educational Planning in the Netherlands", OECD, 1965 (to be published shortly in Manpower Forecasting in Educational Planning).

[3] Handbook on Statistical Needs, op. cit.

of economic growth as the factor which might limit the ability of the labour market to effectively absorb the graduates of the growing educations system. In either case, the educational planner must be concerned about anticipating possible surpluses and shortages of educated manpower.

164. In fact, those who have made the "approach" to planning from these different views have converged in seeing the same problems as objects for more careful study. These problems are essentially those of the relationship between work activity (occupation) and educational background. For example: how do the techniques of production, and the change in these, effect the requirements for education; how broad is the range of educational backgrounds which are appropriate for a given work activity; how do individuals make career choice or what information should they have to make such choice "better"? The answers to these questions are important both to those who wish to improve estimates of the educational requirements for economic growth and for those who wish to insure that individual demands for education should be formulated on the grounds of expectations of future careers which stand a reasonable chance of being realized. The importance of these questions has emerged jointly from the study reported in the previous chapters, the work on Social Objectives in Educational Planning[1] , and the studies of the utilization of highly qualified Manpower[2].

165. Against this background, it is useful to indicate the current state of affairs with respect to the estimation of manpower requirements. Taking first positive achievements, it can be said that in any case estimates of manpower requirements are a necessary part of educational planning and that further research to improve estimation methods is warranted. Even as the methods exist at present they can be used to pick out major potential shortages or surpluses in the labour market. Thus the effort to formulate manpower requirements is justified in terms of current usefulness. Only through the experience accumulated by making such projections and through research on the question already outlined can improvements in methods be expected.

166. The importance of manpower projections must also be looked at from the more general point of view which emphasizes the educational complex as an element in the economic and social system. Considerations of this type have been suggested in previous chapters, but they bear reemphasis here. When used in the "manpower requirements approach", the projections were made by taking the level and composition of economic outputs as the given (the independent variable) and the educational inputs as the thing to be determined (the dependent variable). It is also important to reverse this view. The educational inputs can influence the determination of the level and composition of economic outputs in two ways; first, the availability of various types of educated manpower to be used as inputs in production can affect the rate and nature of economic growth; second, the level of

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[1] Papers from the OECD meeting on this topic will be published shortly.

[2] Background studies prepared for an OECD meeting held in September 1966.

education in the population can influence the tastes of the population and therefore the level and composition of final demands for economic outputs. In addition to these interrelations in terms of real resources, there is the two-way relation between the education system and the economic system in terms of financial resources. The state of the economy both sets the requirements for educational finance through its effect on the required output of the educational system and it also determines the amount of financial resources which can be made available to the educational system. It is clear, therefore, that the information from manpower projections would flow both ways - from economic to educational policy and vice-versa. There should be ideally a certain simultaneity of, or integration in, the determination of the two types of policy planning. Manpower projections help both to indicate the feasibility in educational terms of economic plans and the feasibility in economic terms of educational plans. For this reason, also, the continued improvement of manpower projection methods is warranted and the necessity of moving toward more sophisticated integration of economic and educational planning is clear.

167. Having drawn conclusions about positive aspects, the lessons which have been learned from the awareness of the weaknesses of current manpower projection methods should be indicated. First, while, as stated above, methods of estimating manpower requirements are sufficient, at present, to indicate major potential labour market disequilibrias, it has been shown that a fairly wide range of uncertainty remains with respect to specific long-term requirements. This not only implies a need to refine estimation techniques, but it also leads to suggestions about the qualitative nature of the educational system. If one is somewhat uncertain about the nature of requirements, flexibility in the system and curricula which promote flexibility in the graduates should perhaps be emphasized.

168. A second specific weakness of manpower projections led to similar questions about the qualitative characteristics of the system. An attempt to reduce ignorance about occupational-educational relationships - the major weak point in current manpower methods - stimulated, as part of the OECD programme on Utilization of Highly Qualified Manpower, investigations at the industry and firm level of the relation between educational background and work activity. It was found that the industrial employers of graduates either knew very little about the educational background of their employees or complained that the formal educational system did little to prepare workers for industrial tasks. This raised a very important set of questions: a) is the formal educational system a very inefficient supplier of trained manpower or, b) are the firms very inefficient users of trained manpower or, c) is there simply a logical separation of educational tasks, the formal system supplying general background and the firms and other informal systems supplying specific skills? All this implies a more careful study of the proper curricula content and the role of training and on-the-job experience outside the formal education system. In addition, it suggests an investigation of the operations of the labour market in allocating trained manpower as required.

169. The OECD programme, which was initially centered on investigations of the relation between investments in education and economic growth, has evolved considerably. The accumulation of experience in planning has led to the realization that the inner dynamics of the educational sector must be more fully examined. At the same time, it is clear that the educational sector must be viewed as an entity which operates within a more general economic and social system. An effective programme of research and action in this area must be based upon this concept of education as a system within the larger societal context.

170. It is this systems analysis perspective which creates the awareness of the manner in which the various "approaches" to educational planning fit together. As has been suggested, these "approaches" are connected through the system of education itself. At the same time, education as a sector is an element of the total socio-economic system and the various "approaches" form links to particular aspects of this larger system.

171. From this more sophisticated standpoint, it is evident that educational policy must be integrated with economic and social policy. But this objective can only be achieved when the educational policy maker is equipped with the means to work out the full implications of various educational policy alternatives. It is through programmes such as the Mediterranean Regional Project that the necessary models and methods, including the estimation of manpower requirements, are developed and improved in order that the educational planners and decision makers may be provided with a more complete set of effective tools. The improved procedures which result will hopefully lead to more enlightened and dynamic educational policy formation.

APPENDICES

Appendix I

THE METHODS AND DATA USED IN THE MEDITERRANEAN REGIONAL PROJECT

The basic methods used by each of the MRP Teams in deriving estimates for educational requirements in the target year and the sources of the data utilized in their calculations are very briefly outlined in this chapter. For the purposes of review the elements of the methods used have been grouped into five categories:

i) The projection of economic output; ii) The productivity assumptions; iii) The employed projections, iv) The projections of occupation structure; and v) The conversion to educational requirements. In order to provide easy comparisons among countries, the outline refers to one category at a time and reviews for each of the six countries the particular adaptation and sources used for that element of method. Although such a breakdown into categories does not suit all methods equally well, the basic procedures of each country are adequately represented in the whole.

The information on the methods used was drawn directly from the country reports and from limited conversations with members of the various teams.

Methods of Projecting Output

Unless otherwise noted, the breakdown according to economic sectors followed the International Standard Classification of Industrial Activity.

Italy

Projections of Gross National Product at factor costs and in 1961 prices were made for the period covering 1961 to 1975. The projections were broken down into ten economic sectors and were further divided between North and South Italy.

These data were taken directly from independent estimates made by SVIMEZ. A discussion of factors determining the relative growth of the primary, secondary and tertiary sectors is provided in the text of the report.

Trends in GNP at factor costs 1954 prices from 1951 to 1961 broken down according to the same sectors and North and South are also provided in the text as a basis for comparison. These data were also drawn from those provided by SVIMEZ.

Greece

Projections of Gross Domestic Product at factor costs in 1961 prices for the period 1964-1974 were used. These were broken down according to eight economic sectors. These data were based upon detailed provisional estimates for 1964-1969 and broad perspectives for 1970-1974 drawn up by the Planning Division, Ministry of Co-ordination.

Projections of GNP at 1961 prices for 1974-1979 were made. These data were broken down only according to primary, secondary and tertiary sectors. These projections were made by the MRP Team assuming a slightly lower overall rate of growth than that projected for the 1964-1974 period.

Portugal

GNP estimates at factor costs in 1954 prices for 1950 and 1958 broken down into nine economic sectors given by the National Institute of Statistics (Rapport final préparatoire du troisième Plan de Développement, Etudes générales, 1958) were presented in order to illustrate what were apparently anomalies in the data. On the basis of this demonstration of the unreliability of present data the method of estimating manpower requirements based on economic projections was rejected as statistically unfeasible.

Spain

Projections of GDP at factor costs in 1960 prices for the period 1961 to 1975 were made. The projections are presented in the report in the form of a breakdown into nine economic sectors. The figures were based on the same assumed rate of growth as for the preliminary work on the 1964-1967 Development Plan. Base year data were drawn from provisional figures on the Spanish National Accounts reported by the Ministry of Finance. Projections were made by the MRP Team. A brief description of their procedures is presented in an Annex to this Appendix.

Turkey

Two types of projections of output are given in the Turkish report. Projections of GNP for the period 1962 to 1977 are presented. Projections of an index of real output for the period 1962 to 1977 are broken down into five economic sectors. Projections of an index of value added and value of production for the manufacturing sector are broken down into 13 sub-sectors. All these data are based on figures provided in the 1963-1967 Development Plan and its 15-year perspectives.

Trends in GNP at constant factor costs for 1950 to 1962 for eight economic sectors are presented for purposes of comparison. These data were taken from the OECD Economic Survey - Turkey, 1963.

Yugoslavia

Projections of Social Product (which differs from GDP because of the "non-productive" sectors being excluded which under ISCIA would normally be counted in the Service sector) in 1962 prices for the period 1960 to 1975 are broken down into eight economic sectors (which, with the exception of Arts and Crafts, Trade and Catering, and Municipal Activities, fit the ISCIA Classification). The projections were made by the MRP Team with some co-ordination with preliminary work on the 1964-1970 Yugoslav Plan. Projections were made by considering agriculture, forestry, and manufacturing as "autonomous" and the five remaining sectors as "depending on" the "autonomous" sectors. These estimates were checked against global plan estimates of levels for consumer goods and producer durables. Private sector output was estimated and reported in some tables but it was not used directly in estimating manpower requirements.

Trends in Social Product from 1952 to 1962 broken down into the same eight economic sectors were presented for comparison. A regional breakdown of an index of industrial production for the same period is provided. Both sets of data were drawn up by the Federal Economic Planning Bureau.

Productivity Assumptions

In all cases the index of productivity used was that of output per worker.

Italy

Productivity trends in 1961 prices for the period 1961 to 1975 broken down into ten economic sectors and for North and South Italy were taken from estimates made by SVIMEZ.

Productivity trends in 1954 prices for 1951 and 1961 for the same sectors and areas taken from the same source were also reported.

Greece

Productivity in 1961 prices was projected for the period 1961-1979 according to eight economic sectors. The source given for these projections is the Planning Division, Ministry of Co-ordination but undoubtedly, as with output, the projections from 1974 to 1979 were done by the MRP Team.

Productivity for the period 1961-1971 in the manufacturing sector broken down into 11 sub-sector groups was reported. These data were based on early Plan estimates which assumed a lower growth rate but sub-sector relative growth was assumed to remain the same.

Portugal

Productivity estimates for the year 1950 by nine economic sectors were drawn from the same source as the output data and also used to point up the statistical weaknesses of available data.

Spain

Productivity trends in 1960 prices for the period 1960-1975 for nine economic sectors were estimated by the MRP Figures for the base year were drawn from provisional figures on the Spanish National Accounts reported by the Ministry of Finance and the 1960 Census figures made available by the National Institute of Statistics. A description of factors analyzed in arriving at the productivity estimates is presented in the Annex to this Appendix.

Turkey

A productivity index according to five economic sectors for the period 1962-1977 was drawn up by the MRP Team based upon the development Plan figures.

Yugoslavia

Productivity in 1962 prices for the period 1960-1975 for eight socialised productive branches and the private sector was projected. These estimates were arrived at by the following steps: i) global assessments of anticipated growth in the socialised sector were made assuming slightly faster productivity growth than in the past, ii) consultations with "bodies responsible for various sectors" permitted an evaluation of the impact of such factors as new equipment and incentive system, iii) comparisons were made with the first estimates for the initial stages of the 1964-1970 Plan.

Productivity trends for 1953-1963 estimated by the Federal Planning Bureau for the socialised sector were provided for the purposes of comparison.

Employment

Naturally, for most of the countries the employment projections are simply the resultant of output and productivity projections. In fact, however, the process of building output projections may have started from estimates of population, labour force participation rates and emigration-immigration rates.

Italy

Projections of employment for 1961 to 1975 for ten economic sectors and divided between the North and South were drawn from SVIMEZ estimates.

Employment for ten economic sectors for 1951 to 1961 calculated by SVIMEZ was also presented for comparison.

Greece

Figures for employment for eight economic sectors for the period 1961-1975 were derived from Planning Division data in a manner parallel to that described for output and productivity figures. Underlying demographic projections, analysis of the impact of emigration and assumptions about reduction of unemployment are alluded to in the text.

Employment figures in manufacturing 1961-1974 divided into 11 sub-sectors were drawn from data provided by the Planning Division, Ministry of Co-ordination.

Portugal

1. Employment in 1950 and 1960 distributed among the primary, secondary and tertiary sectors was calculated. The 1950 data were taken from the 1950 census, the 1960 data were derived from a combination of results of a 1960 sample survey of secondary and tertiary sectors carried out by the MRP Team, evaluations for 1958 by the National Institute of Statistics and, for 1959, data provided by the Bank of "Foménto Nacional".

1960 employment figures for metropolitan Portugal for four sectors - extractive industries, manufacturing, construction, electricity -were calculated on the basis of the Team's sample survey.

Projections of population and labour force participation rates for 1960 to 1975 were made. These were based upon estimates by the National Institute of Statistics and OEEC: Revision of Demographic Perspectives 1960, as combined and corrected by the MRP Team. These projections are the primary basis for the estimates of educational requirements.

Spain

Employment for the period 1960 to 1975 is projected for nine economic sectors. Data for the base year was obtained from the 1960 census figures provided by the National Institute of Statistics and projections were derived by the MRP Team from their output and productivity estimates.

Population projections for 1960 to 1975 obtained from the National Institute of Statistics were presented and the manner in which estimates of participation rates and emigration rates were made was briefly discussed in the text.

Turkey

Projections of employment for five economic sectors for 1960 to 1977 were made, evidently based upon Development Plan figures.

Figures for active population for 15 economic sectors from 1955 to 1960 were drawn from the 1955 and 1960 census.

Population projections, unemployment rates and participation rates estimated for 1962-1977 were taken from the Development Plan.

Yugoslavia

Employment for 1960-1975 was calculated for eight "productive" branches and seven "non-productive" branches for the socialised sector, and for three "productive" branches and one "non-productive" branch for the private sector. For the "productive" branches the employment figures were derived jointly with the output and productivity estimates as described above. For "non-productive" branches, estimates were based on present tendencies in employment and the need to "upgrade social services".

Trends in active population 1931 to 1961 were reported according to primary, secondary, tertiary sectors. These data were drawn from census data.

Trends in active population divided according to private and socialised sectors and within the socialised sector into "productive" and "non-productive" branches were taken from the Statistical Yearbook of Yugoslavia and data of the Federal Economic Planning Bureau. Population trends and participation rates for 1961 to 1975 were estimated by the MRP Team using the "Sauvy" method.

Occupational Structure

Before outlining the methods used to determine occupational structure it may be useful to take note of the difficulties commonly encountered in choosing the form of occupational classification to be used. With the exception of Yugoslavia, the MRP Teams used classification schemes which approximate the International Standard Classification of Occupations at various levels of aggregation. The Yugoslavian Team used a classification scheme more directly aligned with formal education qualifications. Obviously, since occupational information has multiple uses any classification scheme which is designed to meet the requirements of more than one potential use will probably contain large elements of compromise. The grossly approximative nature of any such classification scheme becomes particularly evident in the dynamic context of planning. It is perhaps helpful to bear in mind the analogous problem of industrial classification. The homogeneity of industrial groups both over time and among countries is equally as questionable as that of equivalent occupational classifications and yet the International Standard Classification of Industrial Activity seems to have proved useful in forming analytical generalizations. In the outline that follows, differences in classification are not discussed nor described. Data presented in the basic tables of this study will provide some indication of the degrees of comparability.

Italy

Occupational employment for 1975 for six occupation groups and ten economic sectors plus a separate sector for education was calculated. The method used to obtain the full economic sector breakdown is not described. A primary, secondary, tertiary sector breakdown is developed for both a "theoretic" model and an "empirical" model. The "theoretic" model is based on a sociological analysis of the job requirements of each occupation group. The analysis leads up to a definition of an "optimum" structure of the work force for 1975. For the primary, secondary, tertiary sub-divisions of this model "particular elements" requiring differences in relative skill structure were described. The "empirical-practical" model was derived by i) projecting the trend observed in 1951 to 1961 in the relationship between total sector or sub-sector, ii) these projections were "corrected" to take account of special factors such as: a) degree of "rationalization" of the sector or sub-sector, b) established plans for expansion of certain enterprises, c) reference to advanced-country sector or sub-sector occupation patterns as well as those of the most modern firms in Italy, d) general and particular development factors affecting the skill requirements of individual sectors. Surprisingly, the overall results of the projections provided by the two models were quite similar. Although it is not specifically stated in the report, aggregating the

11 sector projections into the primary, secondary, tertiary distribution shows that projections from the "empirical-practical" model were used for final estimates.

Projections for 1975 for six occupational groups for North and South Italy were made by assuming that the proportions of occupation groups in each sector would be the same in the North and South and differences in total employment alone would determine North-South differences.

Occupation by economic sector in 1951 and 1961 for six occupation groups and ten economic sectors plus education as a sector were calculated for comparison purposes and to serve as a basis for projection. The data for 1951 were determined by correcting 1951 Census data for degrees of unemployment. The 1961 Census data were not available; therefore the estimation of detailed figures for this year involved a rather complicated procedure. Estimates for 1961 on occupation by sector, evidently divided into primary, secondary and tertiary sector were taken from the Annuario di statistiche del laboro e dell' emigrazione and distributed into categories comparable to the 1951 classification. These figures were adjusted by taking ISTAT figures on "active population by occupational group" for 1958, 1959, 1960, calculating rates of growth for each occupational group, applying these rates to the 1951 figures and comparing the results with the 1961 estimates determined from the Annuario di Statistiche. The percentage distributions among sectors derived in reconciling these two estimates were applied to 1961 occupation group total employment figures given by SVIMEZ. In order further to divide these figures among sub-sectors two coefficients reflecting a) changes in total employment among sub-sectors from 1951 to 1961 and b) changes in the structure of occupations from 1951 to 1961 in the sector as a whole were calculated and applied to the 1951 data. Certain ambiguities in the description of the steps followed in the application of the coefficient make it difficult to determine the exact procedure.

North-South division by occupation in 1961 for six occupation groups was determined by calculating and applying a coefficient which allowed for the effects of changes in total Southern employment in a sector between 1951 and 1961 but help the internal occupation proportions constant at the 1951 ratios.

Greece

Projections of occupation by economic sector were done for 61 occupation groups from 1961-1974 and for 16 more aggregate groups for 1974-1979 with an eight economic sector breakdown for both periods. Base year data were derived from a combination of several special surveys of various sectors. A description of the method used can be summarized only in their words: "projecting the occupational structure for these years was not done mechanically but depended upon an analysis of present trends in productivity and size of firmes on knowledge of investment plans in certain branches and on very careful judgement". A wide variety of specific factors are cited in the text, even for sub-sectors.

Portugal

Occupation by economic sector was estimated for 1961 for seven occupation groups and eight economic sectors (not including agriculture). These data on metropolitan Portugal were collected by a sample survey conducted by the MRP Team. The sample data were translated into estimates for the total population by using figures from the 1950 census and for 1958 from the National Institute of Statistics and for 1959 from the Bank "Foménto Nacional". No projections of occupations were made but generalizations about the desirable "techniciens supérieurs/techniciens intermédiaires" were utilized in arriving at requirements for education levels in the 1975 population.

Spain

Occupation by economic sector was estimated for 1975 for nine occupation groups and nine economic sectors plus education as a sector. Projections were made by the MRP Team on the basis of: a) occupation structure in the most modern of Spanish enterprises as determined by a survey of a sample of such enterprises and b) information available about the occupation structures of more advanced countries.

The base year data on occupation by economic sector were drawn from a 1% sample of the 1960 population census provided by the National Institute of Statistics and, for the skilled, semi-skilled and unskilled breakdown on enquiry of the Ministry of Labour - Structure of Occupation in Industry and Trade Classified by Economic Activities 1958 - was used.

Turkey

Occupation projections for 1962 to 1977 for 12 occupation groups were made. The method of projection is described as follows: "techniques for projection involve... determination of elasticity of demand as related to output for each occupational category and for each sub-sector on the basis of 1950-1959 experience. These elasticity coefficients have been applied to sub-sector projections of output and employment and rationalized where necessary in the light of present and historical occupational structures of more highly developed economies". It seems, then that data on occupation by economic sector have been utilized though they are not presented in the text.

Trends for 36 occupation groups from 1955 to 1960 were drawn from the 1955 and 1960 Population Census.

Yugoslavia

Figures on occupation by economic sector for 1960 to 1975 were estimated for five occupation groups and eight "productive" sectors and seven "non-productive" sectors. Projections were made in several steps: a) projection of trends observed from 1950 to 1960 were combined with estimated growth in total employment by sector (the projections were done in three "chained" series, 1960-1965, 1965-1970, 1970-1975); b) a survey of selected enterprises in the eight "productive" sectors was taken in order to use their present occupation structure as an estimate of 1975 total sector occupation structure;

c) the ratios of occupations estimated by step a) and step b) were compared with information on such ratios in other countries and, after the problem had been studied by a group of experts from the Federal Planning Bureau, a set of "desirable" ratios was determined;
d) the estimates derived in step a) were used as a final estimate of requirements for the "higher qualification" group and other occupation group requirements were determined by applying the "desirable" ratios, determined in step c) to the "higher qualifications" estimates.

Data for the same occupation groups and sectors for the period 1956 to 1960 were provided by the Federal Planning Bureau.

Conversion to Educational Requirements

Italy

Education by occupation for 1975 for eight education groups and six occupation groups was estimated. It is difficult to determine the method used to establish these estimates. The text provides a general analysis of occupation tasks and statements about the appropriate level of education mixed in with suggestions for reform of educational institutions. These generalizations do not seem sufficiently precise to provide the degree of detail presented in the tables.

A table of education by occupation in 1961 for seven education levels and five occupation levels and five occupation groups is provided in the text of the Italian MRP Report but the source is not indicated.

Greece

A table of the total number of graduates required by education level 1962-1974 is provided in the text of the Greek Report. These figures are divided into those estimated by reference to manpower requirements and those derived by "other" criteria. The links between occupations and education were based on a variaty of assumptions. In general, it seems that occupational categories were analyzed individually and those with obvious close requirements for education, e.g. doctors, were identified. For others, assumptions were made about the percentage of each group requiring a particular level of education, e.g. 40% of new managers were assumed to need an economic or commercial degree. For some categories, e.g. artists, other non-economic criteria were utilized.

Educational requirement estimates for primary and general first cycle secondary education were determined by "demographic factors" and the level of compulsory schooling.

Portugal

Required education levels in the work force for 1960 to 1975 by seven education categories were estimated. The 1975 figures were determined simply by assuming that the percentage of the work force with higher primary teacher training, and full secondary education will be twice as high as the 1960 percentages for these groups. For the middle level education the assumption of a large increase in percentage of the work force was supported by reference to the fact that the ratio of top to middle level technicians in Portugal was much higher than that in advanced countries and that this ratio should, therefore, be considerably lowered by increasing training for middle level technicians. The four-fold increase in the percentages for "classical secondary (1st cycle)" and first cycle technical education was based on the increase in the age limit for compulsory education.

Education by occupation and economic sector for 1960 for 7 education categories, 7 occupation groups and 9 economic sectors was estimated from sample survey data collected by the MRP Team - except for the agricultural sector. To get estimates for agriculture it was assumed that the percentage occupational structure for that sector was the same in 1960 as in 1950 - i.e. as found in the 1950 census - and thus these percentages could be applied to the 1960 total agricultural employment figure. The conversion to education categories in this sector was made by assuming that education levels for each occupation group, except "skilled workers", were the same as those found, by means of the survey in the mining and quarrying sector. For "skilled workers", the education level was assumed to be the same as for the same group in the construction sector.

Spain

Education by occupation group was estimated for 1975 for 6 education categories and 5 occupation groups. The assumptions made about education levels were the following: a) all new scientific and technical workers would have higher education, b) the "other professional workers" category would show a marked increase in the percentage having secondary education, c) there would be a reduction in the percentage of technicians with higher education, d) for administrative and managerial workers and for clerical and sales workers, different assumptions were made for each economic sector. Farmers and manual workers were treated separately under the heading of vocational training.

The base year data: 1960, for the same groups was obtained from a 1% sample of the 1960 census supplied by the National Institute of Statistics.

Turkey

The education level by occupation group was estimated for the period 1962-1977 for 4 education categories and 4 occupation groups. The conversion of occupation to education categories followed exactly the scheme of classifying occupations as A B C D and requiring for all group A a university or higher technical education, for group B a technical education, for group C a secondary or vocational education, and a primary education for all group D.

The comparable data for 1960 were derived from the 1960 census of population and the relevant table in the Report shows the percentage of each of the 4 (A, B, C, D) occupation classes which had education equivalent to those outlined in Forecasting Educational Needs for Economic and Social Development, OECD, 1962.

Yugoslavia

For 10 education categories the requirements for 1960 to 1975 were projected. Since the occupational definitions were very close to educational categories in the first place the conversions were generally quite straightforward. A more detailed breakdown for the higher and secondary qualifications was made and projections established the basis of "norms" defined from partial information on occupation - education for 1953 and 1958.

ANNEX TO APPENDIX I

In Spain, the work on the MRP Report had to be done in particularly difficult circumstances since the first economic development plan (1963-1967) was not available at that time. It might be of interest to summarize here briefly the methods used to arrive at the educational structure of the 1975 labour force.

For Spain then, only a target for an overall growth rate of GNP for the period 1960-1975 had been established. However, the syndicatos had made projections for some sectors up to 1970. The Team used these projections as a starting point, then checked the estimates against data on previous growth of these sectors and compared them with data on Italy. Syndicatos' data also formed the basis for agricultural projections. For other sectors, time-series data and international comparisons were used in forming estimates. A breakdown of the manufacturing sector into ten sub-sectors was used in all calculations - though not presented in the final report data. These calculations provided a sectoral proportioning of total output, but aggregate had to be fitted to the official target growth rate. Validity of inter-industry relationships in projections could be checked only on an "impressionistic" basis.

For productivity assumptions, Syndicatos' data, time-series data and international comparisons once again provided the basis for estimates. Adjustments were made in particular by reference to the "Verdoorn relationship" (or "empirical law" relating productivity to absolute level of output)[1].

Employment was derived directly from the output and productivity assumptions and then checked against population projections provided by the National Statistical Institute. While global requirements for workers fitted potential labour force availability, the rate of emigration assumed turned out to be a key factor. The assumed emigration rate of 150,000 per year - which was considered a very low estimate at the time of the study - led to the requirements of a large increase in female participation rates if the desired employment figures were to be met.

Recent information suggests that the estimated emigration rate is in fact on the high side so that the required level in female participation rates - which, though "high" in terms of the present rate, was not as high as rates in more economically advanced countries - could probably be adjusted downward.

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[1] See P. Verdoorn, "Complementary and long-range Projections", Econometrica, 1956.

Occupation data were derived from surveys of 50 firms in the industrial sector and from data on advanced countries. In general, the practice was for each sector to select from among the advanced countries the one which had a productivity level for the sector equivalent to that estimated for Spain in that sector in 1975. The occupation structure in that sector for the advanced country so selected was taken as the estimated 1975 target occupation structure for Spain. In addition, relationships between productivity and skill structure were analyzed by using cross-sector correlation analysis based on data from advanced countries. Results of this analysis were sufficiently reliable for use as a checking device[1].

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1. The results of this original correlation analysis are reported in H. Thias's "On Estimating Future Shifts in the Occupational Structure of an Industry", OECD, 1963, mimeographed and in L.J. Emmerij and H. Thias "Projecting Manpower Requirements by Occupation", published in Lectures and Methodological Essays on Educational Planning, OECD, 1966.

Appendix II

THE SUBSTITUTION EXAMPLE

The problem in this example was to construct an alternative occupational structure for the target year which would realistically reflect the range of labour substitution possibilities - in the more limited sense of differences in the occupation mix of a sector, total labour productivity of the sector held constant - and then to trace through the implications of such a substitute occupational distribution in terms of the educational requirements estimated for the target year. The range of substitution was to be based upon the data for the base year, in order to provide a realistic estimate.

The method used was based on the assumption that for two countries having roughly the same total labour productivity in a sector, differences in the occupational structure of the two countries would indicate to some extent the degree of possible limited substitution in response to supply differentials.

Spain was chosen as the country for which such an alternative structure would be constructed. The steps taken were as follows:

i) Table N: for each sector in the base year the total labour coefficients (the bottom row in the table) were examined - these coefficients are the number of persons employed per unit of sectoral output - and a second country with a sectoral coefficient very close to that of Spain was selected as an alternative. Thus a different occupational mix giving the same overall product was arrived at. For two sectors, mining and construction, no other countries had total labour coefficients of roughly the same magnitude, so for these sectors no alternatives were constructed.

ii) Table H: for each sector the percentage distribution of occupation groups within the sector of the alternative country, selected as in step i) was subtracted from that of Spain.

The resulting difference in percentage points was taken to be indicative of the range of limited substitution possibility for each occupation in that sector. For example, in the manufacturing sector the alternative country selected was Portugal, and technical and related workers constituted 0.28 per cent of the total sector labour force, as compared to 0.55 per cent for the same group and sector for Spain, thus the difference of 0.27 percentage points was taken to reflect the range of substitution for that occupation and sector.

iii) Table I: the range of substitution calculated for each sector, as in step ii) was applied to the estimated occupational distribution of the same sector for Spain in 1975. This provided a new percentage occupational distribution for each sector. Following the example mentioned in the last step, technical and related workers were projected for 1975 for Spain to constitute 2.1 per cent of the manufacturing sector labour force, applying the substitution range factor of -0.3 per cent; the resultant 1.8 per cent is the alternative estimate for that occupation in that sector. For the mining and construction sectors the estimated 1975 occupation structures were left as estimated - since, as stated in step i) no close alternatives in the base year were available.

iv) Table L: the total labour estimates for 1975 for Spain for each sector were applied to the constructed alternative percentage occupational distribution for the sector. This provided the alternative numbers in each occupation in each sector.

v) The absolute numbers in each occupation in each sector determined in step iv) were totalled for each occupation over all sectors. The result was an alternative estimate of the occupational distribution of the total labour force for Spain for 1975 considered as showing a limited substitution possibility. The total labour force figure was unchanged for that estimated in the Spanish Report, since, as in step iv) the same sector total labour figures were used; however, the distribution of this total among occupations had changed.

vi) From Table 47 in the Spanish Report, the alternative occupational figures were used to calculate the required education stock, in 1975, based on this alternative occupational distribution. This was done by applying the percentage distribution of each occupation among education categories according to the educational requirement for each occupation as presented in the matrix represented by this table in the Spanish Report.

vii) Using information in Table 49 in the Spanish Report with column figures replaced by stock figures as calculated in step vi), the alternative estimate of graduates required over the plan period was obtained. These figures were compared with the original estimates made in the Spanish Report and the results are reported in Table B in the text. The difference in graduate requirements is taken to be the difference which could be obtained by limited occupational substitution - keeping sector labour productivity constant.

Given the appropriate data these results could be further carried out in terms of costs to give alternative cost estimates to be compared with those of the Report.

Appendix III

METHODOLOGICAL NOTE ON TABLES P, Q, R AND S

The purpose of this exercise was to try to evaluate the relative importance, in the projections of these MRP countries, of those factors which make up the changes in employment from one period to another. It should be stated that the factors evaluated in the analysis are not the only ones which could be considered as bringing about changes in employment. In the methodology used for the MRP, however, these are the factors which were taken into consideration. This exercise is designed to make explicit the actual weight of these different factors in the various MRP plans, i.e., to show how important each of them was in determining the final results of the country projections.

The method used can be represented as follows:

Employment of workers of any occupational category "i" in any sector of the economy "j", may be defined as being the product of the following four factors:

a = per cent in occupation "i" of all persons employed in sector "j"
b = number of workers per unit of output of the sector "j" in a given time period
c = per cent of Gross Domestic Product originating in the sector "j"
d = Gross Domestic Product.

The product of these factors is:

$$(abcd) = \frac{\text{(employment occupation "i" in sector "j")}}{\text{(employment sector "j")}} \times \frac{\text{(employment sector "j")}}{\text{(GDP originating sector "j")}} \times \frac{\text{(GDP originating sector "j")}}{\text{GDP}} \times \text{GDP}$$

All terms cancel, leaving only employment of those in occupation "i" in sector "j".

Let L_1 be the employed of occupational category "i" in sector "j" in the base year.

Then $L_1 = a_1\, b_1\, c_1\, d_1$, where a_1, b_1, c_1 and d_1 are the values of a, b, c and d in the base year.

Let L_2 be the employed of occupational category "i" in sector "j" in the target year.

Then $L_2 = a_2\, b_2\, c_2\, d_2$, where a_2, b_2, c_2 and d_2 are the values of a, b, c and d in the target year.

The difference between L_2 and L_1 can be shown as follows, where the term "Δ" is used to mean change:

$$1)\quad \Delta\, abcd = (a_1 + \Delta a)\ (b_1 + \Delta b)\ (c_1 + \Delta c)\ (d_1 + \Delta d) - a_1\, b_1\, c_1\, d_1$$

When this term is expanded and rearranged, we have:

$$\begin{aligned} 2)\quad \Delta\, abcd = {} & (\Delta a b_1 c_1 d_1) + (a_1 b_1 c_1 \Delta d) = (\Delta a b_1 c_1 \Delta d) \\ & + (a_1 \Delta b c_1 d_1) + (\Delta a \Delta b c_1 d_1) + (a_1 \Delta b c_1 \Delta d) \\ & + (\Delta a \Delta b c_1 \Delta d) + (a_1 b_1 \Delta c d_1) + (\Delta a b_1 \Delta c d_1) \\ & + (a_1 b_1 \Delta c \Delta d) + (\Delta a b_1 \Delta c \Delta d) + (a_1 \Delta b \Delta c d_1) \\ & + (\Delta a \Delta b \Delta c d_1) + (a_1 \Delta b \Delta c \Delta d) + (\Delta a \Delta b \Delta c \Delta d). \end{aligned}$$

In order to estimate for each sector the change attributable to each of these factors separately, the computed values of the above terms were divided among a, b, c and d in the following way.

The four terms having only one delta factor were attributed to the factor in question, e.g. the first term in equation 2) is attributed to a. Each of the six terms involving two delta factors was considered as being the result of interaction between the two and thus, divided equally between them. Each of the four terms involving three delta factors was considered as being the result of interaction between the three factors, and divided equally between them. The term involving four delta factors was divided equally between a, b, c and d, for the same reason.

The total change in workers in an occupation for all sectors can be related to each of these four factors simply by summing over all sectors the amounts attributed to the factor in question.

The decision to divide equally between the factors when more than one is involved in a single multiplicative term was reached arbitrarily because there is no non-arbitrary method of doing this. Various proposals to divide proportionately to base year, mid-term or target year values of factors have been made, but any method would be arbitrary and the normal procedure thus far adopted has been to divide equally. For discussing this problem see National Institute Economic Review, p. 60, February 1963, H.S. Levine, "A Small Problem in the Analysis of Growth", Review of Economics and Statistics, May 1960, B.F. Massell, "Another Small Problem in the Analysis of Growth", Review of Economics and Statistics, August 1962.

Appendix IV

METHOD OF ANALYSIS OF IMPACT OF MANPOWER REQUIREMENTS[1]

A.

In order to estimate the flow of graduates required over the period of the plan the educational stock in the "target year" must first be estimated:

Define: L^i - the total labour force in year i (a scalor)
O^j - the percentage distribution of the labour force by occupation in year j (a row vector)
M^k - the percentage distribution of each occupation by levels of education in year k (a matrix)
E^n - the number in the labour force with each education level in year n (a row vector).

The education stock in the labour force in the "target year" is defined by:

1. $L^{75} O^{75} M^{75} = E^r$ where 75 represents the "target year" and r represents Report estimates for that year.

The "base year" stock is defined by:

2. $L^{60} O^{60} M^{60} = E^{60}$ where 60 represents the "base year".

Subtracting the "base year" from the "target year" stock, the result is the required net additions to the educational stock in the labour force:

3. $(E^r - E^{60}) = e^r$ where e^r is required net additions to the stock.

In order to convert net additions to graduate requirements allowance must be made for replacement of losses from the 1960 stock due to death, retirement and net migration and another adjustment must be made for the loss of graduates not entering the labour force (the inverse of graduate labour force participation rates). See Spanish Report Table 51, p. 125 and Table 52, p. 136 for examples.

Thus graduates required are:

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[1] For further refinements of this method see the Annex by Raul Trajtenberg, "A Note on the Methods of Analysis Proposed in the Technical Evaluation of the MRP".

4. $(e^r + R)\ (\frac{1}{p}) = G^r$ where R is replacements required by educational level and p is the participation rate of graduates by educational level.

G^r is the flow of graduates required over the period analyzed - "base year" to "target year". These are the estimates as provided in the various Reports.

B. *The First Stage of the Impact Analysis*

In order to estimate the impact of manpower requirements an estimate is made of what graduate requirements over the period analyzed would be if the labour force grew to the "target year" level (L^{75}) but the occupational distribution remained as it was in the "base year" (0^{60}) and the occupation-education relationships also remained constant (M^{60}). Once again, a stock estimate is formed based on the new assumptions. This estimate can be called the stock required to keep pace with labour force growth.

5. $L^{75}\ 0^{60}\ M^{60} = E^*$ where E^* is the stock required to keep pace with labour force growth.

Substracting the "base year" stock gives the flow requirement:

6. $(E^* - E^{60}) = e^*$

Converting to graduates as in 4, since R and p are unaffected by the changed assumptions:

7. $(e^* + R)\ (\frac{1}{p}) = G^*$

The difference between this estimate (G^*) and the estimate of total requirements (G^r) is the measure of the impact of manpower requirements.

8. $(G^r - G^*)$ = total impact of manpower requirements.

C. *The Second Stage of the Impact Analysis*

In order to handle the second stage more efficiently equation 8 is rewritten in terms of stocks.

9. $$(G^r - G^*) = (e^r + R)\ (\tfrac{1}{p}) - (e^* + R)\ (\tfrac{1}{p}) = (e^r - e^*)\ (\tfrac{1}{p}) =$$
$$\left[(E^r - E^{60}) - (E^* - E^{60})\right](\tfrac{1}{p}) = (E^r - E^*)\ (\tfrac{1}{p})$$

Now ignoring the constant $\frac{1}{p}$, for the moment, the total impact can be represented in terms of the basic definitions:

10. $$(E^r - E^*) = L^{75}\ (0^{60} + \Delta 0)\ (M^{60} + \Delta M) - L^{75}\ 0^{60}\ M^{60}$$
$$\text{where } \Delta 0 = 0^{75} - 0^{60};\ \Delta M = M^{75} - M^{60}$$

Substituting for 0 and M and multiplying out:

10a. $$(E^r - E^*) = L^{75}\ \big[0^{60}\ M^{60} + (0^{75} - 0^{60})\ M^{60} + 0^{60}\ (M^{75} - M^{60})$$
$$+ (0^{75} - 0^{60})\ (M^{75} - M^{60}) - 0^{60}\ M^{60}\big]$$

Grouping terms for the purposes of the analysis:

10b. $$(E^{r} - E^{*}) = \left[L^{75}\ (0^{75} - 0^{60})\right] M^{60} + \left[L^{75}\ 0^{60}\ (M^{75} - M^{60})\right] + \left[L^{75}\ (0^{75} - 0^{60})\ (M^{75} - M^{60})\right]$$

The first term of the right side of 10b can be attributed to the shift in the occupation distribution from the "base year" to the "target year". The second term can be attributed to the shift in the occupational-educational relationships over the same period. The third term is called an "interaction" element.

Define: 11a. $E^{*} = L^{75}\ 0^{75}\ M^{60}$

11b. $E^{-} = L^{75}\ 0^{60}\ M^{75}$

Now the first term of the right side of 10b. can be written:

12. $(L^{75}\ 0^{75}\ M^{60} - L^{75}\ 0^{60}\ M^{60}) = (E^{+} - E^{*})$

Bringing back the constant $(\frac{1}{p})$ dropped after equation 9 the result is:

12a. $(G^{+} - G^{*}) = (E^{+} - E^{*})\ (\frac{1}{p})$

This is the portion of the total impact attributed to the shift in the occupational distribution.

Similarly, the second term of 10b can be written:

13. $(L^{75}\ 0^{60}\ M^{75} - L^{75}\ 0^{60}\ M^{60}) = (E^{-} - E^{*})$

Multiplying by the constant $(\frac{1}{p})$ the result is:

$(G^{-} - G^{*}) = (E^{-} - E^{*})\ (\frac{1}{p})$

This is the portion of the total impact attributed to the shift in the occupational-educational relationships (the amount and type of education associated with each occupation)

The third term 10b can be called the portion attributable to the interaction of the two factors:

14. Interaction $= \left[L^{75}\ (0^{75} - 0^{60})\ (M^{75} - M^{60})\right]\ (\frac{1}{p})$

Using this method, the total impact is portioned among the three elements. The example for Spain is reported in Table D in the text.

D. Impact Analysis for the Italian Data 1951-1961

In the case of the Italian data for 1951-1961, no estimates of graduate participation rates were available so both stages of the analysis were handled in terms of the net additions to stocks rather than in graduate flows. The relative size of elements is not affected by this procedure since differences in net stock additions differ from differences in graduate flows only by the constant $(\frac{1}{p})$.

The total impact was measured directly as in equation 10 but replacing 75 with 61 and 60 with 51. Thus:

15. Total impact for Italy 1951-1961 = $(E^r - E^*) = L^{61}\, O^{61}\, M^{61} - L^{61}\, O^{51}\, M^{51}$

The data available were: L^{51}, L^{61}, O^{51}, O^{61}, M^{61}, but no information about M^{51} was available.

However, there was information on the stock of education in 1951 so that $(O^{51}\, M^{51})$ could be found but M^{51} could not be found separately.

The full second stage analysis could not be carried out because of the unavailability of the occupational-educational relationship for 1951 (M^{51}). However, it was possible to do a partial second stage analysis.

It is necessary to see which of the three portions of the impact, as represented by the three terms in 10b, could be calculated with the data available.

Returning to 10b and combining the first and last terms, i.e. the occupation and interaction elements, and again substituting "61" for "75" and "51" for "60", the result is:

16. $(E^r - E^*) = L^{61}\, (O^{61} - O^{51})\, \left[M^{51} + (M^{61} - M^{51})\right] + \left[L^{61}\, O^{51}\, (M^{61} - M^{51})\right]$

Multiplying out and simplifying

16a. $(E^r - E^*) = L^{61}\, (O^{61} - O^{51})\, M^{61} - \left[L^{61}\, O^{51}\, (M^{61} - M^{51})\right]$

With the data available for Italy for 1951-1961 the first term in right side of 16a could be calculated but the second could not be calculated directly since M^{51} was not given. However, the second term could be calculated by subtracting the first term from $(E^r - E^*)$, which had already been calculated as shown in 15.

17. $(E'' - E^*) = L^{61}\, O^{51}\, (M^{61} - M^{51}) = (E^r - E^*) - \left[L^{61}\, (O^{61} - O^{51})\, M^{61}\right]$

This term $(E'' - E^*)$ is the portion of the total impact attributable to the shift in occupational-educational relationship. The portions attributable to occupational shift and interaction could not be separated because the indices for M^{51} were not given. The portion attributed to shift in the occupational-educational relationships could be calculated because, in equation 16, the terms attributed to the other two factors were combined.

Annex V

COMPARATIVE STATISTICS FOR THE MEDITERRANEAN REGIONAL PROJECT COUNTRIES

Table H. DISTRIBUTION OF EMPLOYMENT[a]

DIVISION OF ECONOMIC ACTIVITY / OCCUPATIONAL CATEGORY	FIGURES BELOW REPRESENT:	AGRICULTURE				MINING			
		S	G	P	I	S	G	P	I
Scientific and technical professional workers	Employed (000's)	4.8[c]	2.1	8.9[c]	17.4[f]	1.6	0.2	0.1[e]	1.5
	% of those in occupational category in sector	3.9	7.3	4.6	1.8	1.3	0.7	0.5	0.2
	% of employed in sector	0.1	0.1	..	0.3	0.8	0.9	0.4	1.0
Other professional workers	Employed (000's)	.. [c]	0.3	.. [c]	.. [f]	1.0	0.3	.. [e]	..
	% of those in occupational category in sector	..	0.4	..	..	0.4	0.4	..	..
	% of employed in sector	..	-	..	..	0.5	1.4	..	..
Administrative executive and managerial workers	Employed (000's)	-	0.1	-	.. [f]	1.2	0.1	0.1	..
	% of those in occupational category in sector	-	0.6	-	..	1.0	0.6	0.3	..
	% of employed in sector	-	-	-	..	0.6	0.4	0.4	..
Technical and related workers	Employed (000's)	.. [c]	0.5	0.2	23.2	1.4	..	0.1	1.6
	% of those in occupational category in sector	..	1.1	0.6	3.5	1.8	..	0.3	0.2
	% of employed in sector	..	-	..	0.4	0.7	..	0.4	1.1
Clerical and sales workers	Employed (000's)	9.6	-	0.9	-	8.6	2.3	1.0	2.8
	% of those in occupational category in sector	0.7	-	0.4	-	0.6	0.5	0.4	0.1
	% of employed in sector	0.2	-	..	-	4.2	10.5	4.0	1.9
Farmers cattlebreeders and fishermen, etc.	Employed (000's)	4,788.9	1,722.0	1,538.0	5,759.4	-	-	-	-
	% of those in occupational category in sector	100.0	100.0	100.0	100.0	-	-	-	-
	% of employed in sector	99.7	99.8	99.9	99.3	-	-	-	-
Total workers (i, ii and iii)	Employed (000's)	-	-	-	-	189.7	19.1	23.7	144.1
	% of those in occupational category in sector	-	-	-	-	4.0	1.9	1.5	1.5
	% of employed in sector	-	-	-	-	93.2	86.8	94.8	96.0
i. Skilled workers	Employed (000's)	-	-	-	-	57.0	0.5	1.1	0.6
	% of those in occupational category in sector	-	-	-	-	..	0.2	2.8	0.3
	% of employed in sector	-	-	-	-	28.0	2.3	4.4	0.4
ii. Semi-skilled workers	Employed (000's)	-	-	-	-	42.7	9.6	2.6	118.0
	% of those in occupational category in sector	-	-	-	-	..	3.2	0.7	2.9
	% of employed in sector	-	-	-	-	21.0	43.6	10.4	78.6
iii. Unskilled workers	Employed (000's)	-	-	-	-	90.0	9.0	20.0	25.5
	% of those in occupational category in sector	-	-	-	-	..	2.2	1.8	0.4
	% of employed in sector	-	-	-	-	44.2	40.9	80.0	17.0
TOTAL	Employed (000's)	4,803.3	1,725.0	1,540.0	5,800.0	203.5	22.0	25.0	150.0
	% of those in occupational category in sector	41.3	50.7	44.9	29.9	1.7	0.7	0.7	0.8
	% of employed in sector	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

G = Greece
I = Italy
P = Portugal
S = Spain

Y OCCUPATIONAL CATEGORIES[b] AND DIVISION OF ECONOMIC ACTIVITY

Base year

MANUFACTURE				CONSTRUCTIÓN				ELECTRICITY, GAS, WATER				INDUSTRY TOTAL			
S	G	P	I	S	G	P	I	S	G	P	I	S	G	P	I
19.1	1.8	3.5[e]	92.0[f]	7.0	3.3	1.2[e]	21.2[f]	2.9	0.7	0.4[e]	2.0[f]	30.6	6.0	5.2[e]	118.7[f]
15.5	6.2	17.8	9.5	5.7	11.5	6.1	2.2	2.3	2.4	2.0	0.2	24.8	20.8	26.4	12.1
0.75	0.4	0.5	1.8	0.85	2.7	0.6	1.1	3.6	3.8	2.9	1.8	0.8	0.9	0.5	1.6
15.3	3.1	.. [e]	.. [f]	0.8	..	.. [e]	.. [f]	0.2	0.1	.. [e]	.. [f]	17.3	3.5	..	.. [f]
5.5	3.7	..	..	0.3	..	..	..	0.1	0.1	..	..	6.3	4.2	..	..
0.6	0.6	..	..	0.1	..	..	..	0.2	0.5	..	..	0.5	0.5	..	..
48.4	6.2	6.2	.. [f]	7.0	0.1	2.1	.. [f]	0.6	0.1	0.2	.. [f]	57.2	6.5	8.6	.. [f]
40.3	34.6	15.8	..	5.8	0.6	5.4	..	0.5	0.6	0.5	..	47.6	36.3	22.0	..
1.9	1.2	0.9	..	0.85	0.1	1.0	..	0.8	0.5	1.4	..	1.6	1.0	0.9	..
14.0	3.1	2.0	178.9	4.1	8.1	0.4	63.7	1.3	0.9	0.3	15.3	20.8	12.1	2.8	259.5
17.6	6.8	6.3	26.8	5.2	17.8	1.3	8.6	1.6	1.9	0.9	2.3	26.2	26.5	8.8	38.9
0.55	0.6	0.3	3.5	0.5	6.5	0.2	3.3	1.6	4.8	2.1	13.9	0.6	1.8	0.3	3.5
241.9	63.0	38.4	240.1	41.1	3.2	5.4	34.7	15.4	3.6	2.3	20.2	307.0	72.1	47.1	297.8
17.4	15.3	15.4	10.7	3.0	0.8	2.2	1.5	1.1	0.9	0.9	0.9	22.1	17.5	18.9	13.2
9.5	12.3	5.4	4.7	5.0	2.6	2.5	1.8	19.0	19.4	16.4	18.4	8.4	10.7	4.9	4.1
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
207.3	433.3	660.8	4,599.0	762.1	109.3	202.9	1,810.4	60.5	13.2	10.8	72.5	3,219.6	574.8	898.2	6,626.0
46.9	43.8	42.7	47.1	16.2	11.1	13.1	18.6	1.3	1.3	0.7	0.7	68.4	58.1	58.0	67.9
86.7	84.9	92.9	90.0	92.7	88.1	95.7	93.8	74.8	71.0	77.2	65.9	88.1	85.1	93.4	90.8
636.5	204.7	21.1	46.0	221.1	46.2	8.1	92.6	25.4	4.0	0.6	4.2	940.0	254.9	30.9	143.4
..	73.0	54.4	23.8	..	16.5	20.9	48.0	..	1.4	1.5	2.2	..	91.1	79.6	74.3
25.0	40.0	3.0	0.9	26.9	37.2	3.8	4.8	31.4	21.5	4.3	3.8	25.7	37.7	3.2	2.0
799.4	123.3	188.5	3,398.1	106.9	..	54.9	291.5	10.6	0.3	4.1	40.7	959.6	133.2	250.1	3,848.3
..	40.9	48.0	82.6	..	..	14.0	7.1	..	0.1	1.0	1.0	..	44.2	63.7	93.6
31.4	24.2	26.5	66.5	13.0	..	25.9	15.1	13.1	1.6	29.3	37.0	26.3	19.7	26.0	52.7
771.4	105.8	451.2	1,154.9	434.1	63.1	139.9	1,426.3	24.5	8.9	6.1	27.6	1,320.0	186.7	617.2	2,634.3
..	25.9	40.4	21.2	..	15.4	12.5	26.2	..	2.2	0.5	0.5	..	45.7	55.2	48.3
30.3	20.7	63.4	22.6	52.8	50.9	66.0	73.9	30.3	47.9	43.6	25.1	36.1	27.7	64.2	36.1
546.0	510.5	710.9	5,110.0	822.1	124.0	212.0	1,930.0	80.9	18.6	14.0	110.0	3,652.5	675.0	961.9	7,300.0
21.9	15.0	20.8	26.3	7.1	3.6	6.2	9.9	0.7	0.6	0.4	0.6	31.4	19.9	28.1	37.6
100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table H. (cont'd) DISTRIBUTION OF EMPLOYMENT[a]

DIVISION OF ECONOMIC ACTIVITY / OCCUPATIONAL CATEGORY	FIGURES BELOW REPRESENT:	TRADE, BANKS, INSURANCE				TRANSPORT, COMMUNICATIONS			
		S	G	P	I	S	G	P	I
Scientific and technical professional workers	Employed (000's)	3.6	3.8	2.6[e]	186.4[f]	2.7	0.5	0.9[e]	23.0[f]
	% of those in occupational category in sector	2.9	13.2	13.2	19.3	2.2	1.7	4.6	2.4
	% of employed in sector	0.4	1.2	0.9	7.3	0.5	0.3	0.65	2.0
Other professional workers	Employed (000's)	1.2	6.3	.. [e]	.. [f]	1.1	0.5	.. [e]	.. [f]
	% of those in occupational category in sector	0.4	7.5	..	..	0.4	0.6	..	..
	% of employed in sector	0.1	2.0	..	..	0.2	0.3	..	..
Administrative executive and managerial workers	Employed (000's)	26.6	2.8	8.2	.. [f]	4.8	3.2	0.9	.. [f]
	% of those in occupational category in sector	22.1	15.6	21.0	..	4.0	17.9	2.3	..
	% of employed in sector	2.8	0.9	2.9	..	0.9	1.6	0.65	..
Technical and related workers	Employed (000's)	6.2	1.2	0.7	13.4	1.6	13.1	0.4	93.1
	% of those in occupational category in sector	7.8	2.6	2.2	2.0	2.0	28.7	1.3	14.0
	% of employed in sector	0.7	0.4	0.2	0.5	0.3	6.7	0.3	8.1
Clerical and sales workers	Employed (000's)	801.8	230.1	160.1	1,455.5	51.0	8.2	7.6	176.0
	% of those in occupational category in sector	57.7	55.8	64.3	64.6	3.7	2.0	3.1	7.8
	% of employed in sector	84.8	74.2	56.3	57.1	9.5	4.2	5.6	15.3
Farmers cattlebreeders and fishermen, etc.	Employed (000's)	-	-	-	-	-	-	-	-
	% of those in occupational category in sector	-	-	-	-	-	-	-	-
	% of employed in sector	-	-	-	-	-	-	-	-
Total workers (i, ii and iii)	Employed (000's)	105.7[d]	66.0	112.5	894.7	475.3[d]	168.8	126.7	857.9
	% of those in occupational category in sector	2.3	6.7	7.2	9.2	10.1	17.0	8.2	8.8
	% of employed in sector	11.2	21.3	39.7	35.1	88.6	86.9	92.8	74.6
i. Skilled workers	Employed (000's)	..	2.3	2.2	3.0	..	7.4	3.7	35.6
	% of those in occupational category in sector	..	0.8	5.7	1.6	..	2.7	9.5	18.4
	% of employed in sector	..	0.8	0.8	0.1	..	3.8	2.7	3.1
ii. Semi-skilled workers	Employed (000's)	..	..	15.5	..	..	129.0	80.0	256.5
	% of those in occupational category in sector	..	..	3.9	..	..	42.8	20.4	6.2
	% of employed in sector	..	..	5.5	..	..	66.4	58.6	22.3
iii. Unskilled workers	Employed (000's)	..	63.7	94.8	891.7	..	32.4	43.0	565.8
	% of those in occupational category in sector	..	15.6	8.5	16.4	..	7.9	3.8	10.4
	% of employed in sector	..	20.5	33.4	35.0	..	16.7	31.5	49.2
TOTAL	Employed (000's)	945.1	310.2	284.1	2,550.0	536.5	194.3	136.5	1,150.0
	% of those in occupational category in sector	8.1	9.1	8.3	13.1	4.6	5.7	4.0	6.0
	% of employed in sector	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

G = Greece
I = Italy
P = Portugal
S = Spain

OCCUPATIONAL CATEGORIES[b] AND DIVISIONS OF ECONOMIC ACTIVITY

Base year

GOVERNMENT AND OTHER SERVICES (EXCLUDING EDUCATION)				EDUCATION				SERVICES TOTAL				TOTAL			
S[h]	G[k]	P[l]	I	S	G	P[l]	I	S[h]	G[k]	P	I	S[h]	G[k]	P	I
76.3	16.4	10.1[e]	201.2[f]	5.6	..	..	422.0[f]	88.2	20.7	13.6[e]	832.6[f]	123.6	28.8	19.7[e]	966.7[f]
61.7	56.9	51.2	20.8	4.5	..	..	43.6	71.3	71.9	69.0	86.1	100.0	100.0	100.0	100.0
5.5	4.6	2.0	9.2	3.5	..	..	100.0	2.9	2.3	1.5	13.2	1.1	0.9	0.6	5.0
20.6	33.0	.. [e]	.. [f]	137.6	39.9[j]	..	.. [f]	260.5	79.7	.. [e]	.. [f]	277.8	83.5	.. [e]	.. [f]
43.4	39.5	..	..	49.5	47.8	..	..	93.7	95.4	..	..	100.0	100.0	..	..
8.7	9.3	..	..	86.0	100.0	..	..	8.6	8.9	..	..	2.4	2.5	..	..
30.5	5.3	21.4	.. [f]	1.1	..	..	.. [f]	63.0	11.3	30.5	.. [f]	120.2	17.9	39.1	.. [f]
25.4	29.6	54.7	..	0.9	..	..	..	52.4	63.1	78.0	..	100.0	100.0	100.0	..
2.2	1.5	4.3	..	0.7	..	..	..	2.1	1.3	3.3	..	1.0	0.5	1.1	..
48.5	18.7	27.7	277.5	2.2	..	..	..	58.5	33.0	28.8	384.0	79.3	45.6	31.8	666.7
61.2	41.0	87.1	41.6	2.8	..	..	..	73.8	72.4	90.6	57.6	100.0	100.0	100.0	100.0
3.5	5.3	5.5	12.8	1.4	..	..	..	1.9	3.7	3.1	6.1	0.7	1.4	0.9	3.4
10.8	101.7	33.3	323.7	8.2	..	..	..	1,071.8	340.0	201.0	1,955.2	1,388.4	412.1	249.0	2,253.0
15.2	24.7	13.3	14.4	0.6	..	..	..	77.2	82.5	80.7	86.8	100.0	100.0	100.0	100.0
15.2	28.6	6.6	14.9	5.1	..	..	..	35.4	37.8	21.7	31.0	12.1	12.5	7.3	11.6
-	-	-	-	-	-	-	-	-	-	-	-	4,788.9	1,722.0	1,538.0	5,759.4
-	-	-	-	-	-	-	-	-	-	-	-	100.0	100.0	100.0	100.0
-	-	-	-	-	-	-	-	-	-	-	-	41.7	52.2	44.9	29.7
00.0[d]	180.0	411.9	1,375.6	5.3	..	..	..	1,486.3[d]	414.8	651.1	3,128.2	4,705.9	989.7	1,549.3	9,754.2
19.1	18.2	26.6	14.1	0.1	..	..	..	31.6	41.9	42.0	32.1	100.0	100.0	100.0	100.0
64.9	50.7	81.6	63.1	3.3	..	..	..	49.1	46.1	70.4	49.7	41.0	30.0	45.2	50.3
..	15.1	2.0	11.1	..	..	..	..	..	24.8	7.9	49.7	940.0[g]	279.7	38.8	193.1
..	5.4	5.2	5.7	..	..	..	..	..	8.9	20.4	25.7	..	100.0	100.0	100.0
..	4.3	0.4	0.5	..	..	..	..	..	2.7	0.9	0.8	8.2	8.5	1.1	1.0
..	39.2	47.1	7.2	..	..	..	..	..	168.2	142.6	263.7	959.6[g]	301.4	392.7	4,112.0
..	13.0	12.0	0.2	..	..	..	..	..	55.8	36.3	6.4	..	100.0	100.0	100.0
..	11.0	9.3	0.3	..	..	..	..	..	18.7	15.4	4.2	8.4	9.1	11.5	21.2
..	125.7	362.8	1,357.3	..	..	..	..	..	221.8	500.6	2,814.6	1,320.0[g]	408.6	1,117.8	5,449.1
..	30.8	32.5	24.9	..	..	..	..	..	54.3	44.8	51.7	..	100.0	100.0	100.0
..	35.4	71.9	62.3	..	..	..	..	..	24.7	54.1	44.7	11.5	12.4	32.6	28.1
36.7	455.6	504.4	2,178.0	160.0	39.9[j]	..	422.0	3,178.3	1,000.0	925.0	6,300.0	11,634.1	3,400.0	3,426.9	19,400.0
13.2	13.4	14.7	11.2	1.4	1.2	..	2.2	27.3	29.4	27.0	32.5	100.0	100.0	100.0	100.0
00.0	100.0	100.0	100.0	100.0	100.0	..	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table I. DISTRIBUTION OF EMPLOYMENT[a] BY OCCUPATIONAL CATEGOR

DIVISION OF ECONOMIC ACTIVITY / OCCUPATIONAL CATEGORY	FIGURES REFER TO:	AGRICULTURE			MINING			MANUFACTURE			CONSTRUCTION			ELECTRICITY, GAS AND WATER		
		S	G	I	S	G	I	S	G	I	S	G	I	S	G	I
Scientific and technical professional workers	Employed (000's)	7.4	3.7	20.0[f]	2.0	0.3	5.4[f]	38.4	4.1	267.3[f]	10.0	6.0	147.6[f]	3.7	1.7	8.
	% of all in occupation in sector	4.4	8.5	1.1	1.2	0.7	0.3	22.7	9.3	14.9	5.9	13.7	8.2	2.2	3.9	0.
	% of employed in sector	0.2	0.3	0.5	0.9	0.8	3.0	1.1	0.6	4.2	0.8	3.5	6.0	3.0	5.3	6.
Other professional workers	Employed (000's)	..	0.8	..[f]	0.9	0.4	..[f]	14.0	4.8	..[f]	2.5	0.1	..[f]	0.5	0.2	..
	% of all in occupation in sector	..	0.7	..	0.2	0.4	..	3.1	4.1	..	0.5	0.1	..	0.1	0.2	..
	% of employed in sector	..	..	..	0.4	1.1	..	0.4	0.6	..	0.2	..	..	0.4	0.6	..
Administrative, executive and managerial workers	Employed (000's)	3.7	0.1	..[f]	2.4	0.2	..[f]	97.7	7.7	..[f]	24.9	0.3	..[f]	1.3	0.1	..
	% of all in occupation in sector	1.4	0.4	..	0.9	0.8	..	38.7	29.6	..	9.3	1.1	..	0.5	0.4	..
	% of employed in sector	0.1	..	..	1.1	0.6	..	2.8	1.1	..	2.0	0.2	..	1.1	0.3	..
Technical and related workers	Employed (000's)	11.1	0.8	60.0	3.7	0.2	9.0	73.3	7.1	756.3	14.9	14.6	270.6	5.3	2.2	21.
	% of all in occupation in sector	4.5	1.1	2.8	1.5	0.3	0.4	29.7	9.5	35.5	6.0	19.5	12.7	2.2	2.9	1.
	% of employed in sector	0.3	..	1.5	1.7	0.6	5.0	2.1	1.0	11.8	1.2	8.4	11.0	4.3	6.9	15.
Clerical and sales workers	Employed (000's)	18.6	-	-	10.8	1.5	10.8	418.7	71.4	541.2	62.3	7.1	123.0	27.1	5.1	21
	% of all in occupation in sector	0.8	-	-	0.5	0.3	0.3	18.6	12.2	13.5	2.8	1.2	3.0	1.2	0.9	0.
	% of employed in sector	0.5	-	-	4.9	4.3	6.0	12.0	10.1	8.4	5.0	4.1	5.0	22.0	15.9	15.
Farmers, cattlebreeders and fishermen	Employed (000's)	3,672.4	1,394.6	3,920.0	-	-	-	-	-	-	-	-	-	-	-	-
	% of all in occupation in sector	100.0	100.0	100.0	-	-	-	-	-	-	-	-	-	-	-	-
	% of employed in sector	98.9	99.6	98.0	-	-	-	-	-	-	-	-	-	-	-	
Total workers (i, ii and iii)	Employed (000's)	-	-	-	200.5	32.4	154.8	2,847.3	615.1	4,855.2	1,130.3	144.9	1,918.8	85.1	22.7	88
	% of all in occupation in sector	-	-	-	3.2	2.3	1.6	44.8	44.5	49.3	17.8	10.5	19.5	1.3	1.6	0
	% of employed in sector	-	-	-	91.0	92.6	86.0	81.6	86.6	75.6	90.8	83.8	78.0	69.2	71.0	64
i. Skilled workers	Employed (000's)	-	-	-	74.9	0.8	9.0	991.0	257.8	245.6	435.7	78.3	147.6	49.2	10.3	8
	% of all in occupation in sector	-	-	-	4.8	0.2	1.2	63.9	67.5	32.5	28.1	20.5	19.6	3.3	2.7	1
	% of employed in sector	-	-	-	34.0	2.3	5.0	28.4	38.3	3.8	35.0[e]	45.3	6.0	40.0	33.2	6
ii. Semi-skilled workers	Employed (000's)	-	-	-	44.1	17.6	124.2	1,170.4	198.8	4,218.4	112.0	..	1,107.0	12.3	0.4	58
	% of all in occupation in sector	-	-	-	3.3	3.5	1.8	87.5	39.6	63.1	8.3	..	16.6	0.9	0.1	0
	% of employed in sector	-	-	-	20.0	50.3	69.0	33.8	28.0	65.7	9.0	..	45.0	10.0	1.3	42
iii. Unskilled workers	Employed (000's)	-	-	-	81.5	14.0	21.6	676.9	158.5	391.2	582.6	66.6	684.2	23.6	12.0	22
	% of all in occupation in sector	-	-	-	6.0	2.8	0.9	49.6	31.7	16.3	42.7	13.3	27.7	1.7	12.4	1
	% of employed in sector	-	-	-	37.0	40.0	12.0	19.4	22.3	6.1	46.8	38.5	27.0	19.2	37.5	18
TOTAL	Employed (000's)	3,713.2	1,400.0	4,000.0	220.3	35.0	180.0	3,489.4	710.0	6,420.8	1,244.9	173.0	2,460.0	123.0	32.0	140
	% of all in occupation in sector	27.4	37.8	18.4	1.6	0.9	0.8	25.7	19.2	29.6	9.2	4.7	11.3	0.9	0.9	0
	% of employed in sector	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100

ND DIVISIONS OF ECONOMIC ACTIVITY - TARGET YEAR

INDUSTRY TOTAL			TRADE BANKS AND INSURANCE			TRANSPORT AND COMMUNICATIONS			GOVERNMENT AND OTHER SERVICES (EXCLUDING EDUCATION)			EDUCATION			SERVICES TOTAL			TOTAL ALL OCCUPATIONS		
S	G	I	S	G	I	S	G	I	S[h]	G[h]	I	S[l]	G	I	S[h]	G[h]	I	S[h]	G[h]	I
54.1	12.1	428.7[f]	8.6	4.9	318.0[f]	4.0	0.8	75.0[f]	82.4	22.3	402.5[f]	12.3	..	550.0[f]	107.3	28.0	1,345.5[f]	168.8	43.8	1,794.2[f]
32.0	27.6	23.9	5.1	11.2	17.7	2.4	1.8	4.2	48.8	50.9	22.4	7.3	..	30.7	63.6	63.9	75.0	100.0	100.0	100.0
1.1	1.3	4.6	0.6	1.1	9.6	0.5	0.3	5.0	4.2	4.6	12.8	3.5	..	100.0	2.2	2.2	15.8	1.3	1.2	8.3
17.9	5.3	..[f]	5.3	8.6	..[f]	4.0	1.1	..[f]	127.5	42.5	..[f]	301.0	53.2[m]	..[f]	437.8	104.6	..[f]	455.7	110.7	..[f]
3.9	4.8	..	1.2	7.9	..	0.9	1.0	..	28.0	38.4	..	66.0	47.2	..	96.1	94.5	..	100.0	100.0	..
0.4	0.6	..	0.4	2.0	..	0.5	0.4	..	6.5	8.8	..	86.0	100.0	..	9.2	8.3	..	3.4	3.1	..
136.3	3.3	..[f]	53.4	3.8	..[f]	8.1	5.3	..[f]	72.6	6.6	..[f]	2.5	..	..[f]	136.6	17.6	..[f]	266.6	26.0	..[f]
47.4	31.9	..	20.0	14.6	..	3.0	20.0	..	27.2	33.1	..	1.0	..	..	51.2	..	..	100.0	100.0	..
2.5	0.9	..	3.6	0.9	..	1.0	1.7	..	3.7	1.8	..	0.7	..	..	2.9	1.4	..	2.0	0.7	..
97.2	24.1	1,050.9	15.7	2.1	240.0	8.1	22.3	355.0	100.8	25.6	518.0	4.9	..	..	128.5	50.0	1,013.0	246.8	74.9	2,120.9
39.4	32.2	49.6	6.4	2.8	11.3	3.3	29.8	12.0	44.5	34.1	24.3	1.9	..	..	58.1	66.7	47.6	100.0	100.0	100.0
1.9	2.5	11.5	1.0	0.5	2.3	1.0	7.4	17.0	5.6	5.3	18.5	1.4	..	..	2.9	3.9	11.9	1.8	3.1	8.8
18.9	66.1	690.0	1,270.0	342.6	2,004.0	105.2	15.4	330.0	311.9	139.8	987.0	17.8	..	..	1,715.9	497.8	3,321.0	2,251.4	383.9	4,017.0
23.1	14.6	17.3	56.6	58.8	49.9	4.7	2.6	8.2	13.8	24.0	24.6	0.8	..	..	76.1	86.4	82.7	100.0	100.0	100.0
10.2	9.0	7.6	85.1	79.7	60.7	13.0	5.2	22.0	15.9	28.8	31.3	5.1	..	..	35.9	39.3	39.1	16.8	18.1	18.5
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,672.4	1,384.8	3,820.0
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	27.4	28.5	18.1
63.2	815.1	7,018.4	140.5[d]	67.8	728.0	678.6[d]	255.2	840.0	1,257.3[d]	246.2	1,242.5	11.9[d]	..	..	2,088.9[d]	569.2	2,820.5	6,352.1	1,394.3	9,838.9
67.1	58.0	71.3	2.2	4.9	7.5	10.7	18.4	8.6	19.8	17.6	12.6	0.3	..	..	32.9	41.1	28.7	100.0	100.0	100.0
83.9	85.7	76.3	9.3	15.8	22.3	84.0	85.0	56.0	64.1	50.7	39.4	3.3	..	..	43.8	44.9	33.2	47.3	29.3	45.3
50.0	347.2	410.6	..	3.8	153.0	..	11.8	90.0	..	19.1	101.5	..	..	..	..	34.7	364.5	1,550.0	381.9	755.1
00.0	90.9	54.4	..	1.0	20.3	..	3.1	11.9	..	5.0	13.4	..	..	..	..	9.1	48.6	100.0	100.0	100.0
30.5	38.5	4.5	..	0.9	4.6	..	3.9	6.0	..	3.9	3.2	..	..	..	..	2.7	4.1	11.6	10.6	3.5
47.8	216.8	5,508.4	..	..	..	..	223.3	480.0	..	62.0	700.0	..	..	..	..	285.3	1,180.0	1,247.8	502.1	6,688.4
00.0	43.2	82.4	..	..	..	..	44.5	7.2	..	12.3	10.4	..	..	..	..	56.8	17.6	100.0	100.0	100.0
28.5	22.8	59.9	..	..	..	..	74.4	32.0	..	12.8	22.2	..	..	..	..	22.5	13.9	10.0	13.0	20.9
64.8	251.1	1,099.4	..	64.0	585.0	..	20.1	270.0	..	165.1	441.0	..	..	..	..	249.2	1,296.0	1,364.0	500.2	2,395.4
00.0	50.2	45.9	..	12.8	24.4	..	4.0	11.3	..	33.0	18.4	..	..	..	..	49.8	54.1	100.0	100.0	100.0
28.9	28.4	11.9	..	14.9	17.7	..	6.7	18.0	..	34.0	14.0	..	..	..	..	19.7	15.2	10.2	13.8	11.0
77.6	850.0	9,200.0	1,599.5	430.0	3,300.0	800.0	300.0	1,500.0	2,111.5	567.8	3,150.0	350.0	53.2[m]	550.0	4,773.0	1,350.0	8,300.0	13,583.8	3,700.0	21,700.0
37.4	23.7	42.4	11.1	11.6	15.2	5.9	8.1	6.9	15.6	15.4	14.5	2.6	1.4	2.6	35.2	36.5	38.2	100.0	100.0	100.0
00.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

G = Greece
I = Italy
S = Spain

Table J. GROSS DOMESTIC PRODUCT BY SECTOR OF ORIGI

MAJOR DIVISIONS OF ECONOMIC ACTIVITY		10^6 DRACHMAE AT 1961 PRICES			10^9 LIRE AT 1961 PRICES			10^6 ESCUDOS AT 1960 PRICE
		GREECE[a]			ITALY[b]			PORTUGAL[c]
		BASE YEAR 1961	TARGET YEAR 1974	AVERAGE ANNUAL % CHANGE 1961-74	BASE YEAR 1961	TARGET YEAR 1975	AVERAGE ANNUAL % CHANGE 1961-75	BASE YEAR 1960
Agriculture		28,400.0	43,400.0	3.3	3 297.0	4,350.0	2.0	16,171.0
	%	30.2	19.8		17.0	11.0		25.3
Mining		1,116.0	3,750.0	9.8	208.0	500.0	6.5	422.0
	%	1.2	1.7		1.1	1.3		0.7
Manufacture		17,174.0	52,640.0	9.0	6,327.0	16,320.0	7.0	25,970.0[d]
	%	18.3	24.0		32.6	41.3		37.5
Construction		5,290.0	15,460.0	8.6	1,405.0	3,620.0	7.0	.. [d]
	%	5.6	7.1		7.2	9.1		..
Electricity, gas and water	%	1,476.0 1.6	6,950.0 3.2	12.7	527.0 2.7	1,450.0 3.7	7.3	1,595.0 2.5
Industry total		25,056.0	78,800.0	9.2	8,467.0	21,890.0	7.0	25,987.0
	%	26.7	36.0		43.6	55.4		40.7
Trade, banks and insurance	%	13,026.0 13.9	29,980.0 13.7	6.6	2,488.0 12.8	4,180.0 10.6	3.5	6,381.0 10.0
Transport and communications	%	7,292.0 7.8	18,180.0 8.3	7.3	1,331.0 6.8	2,360.0 6.0	4.2	3,563.0 5.6
Government and other services	%	20,023.0 21.4	48,540.0 22.2	7.0	3,856.0 19.8	6,750.0 17.0	3.8	11,764.0 18.4
Services total		40,341.0	96,700.0	7.0	7,675.0	13,290.0	4.0	21,708.0
	%	43.1	44.2		39.4	33.6		34.0
Total		93,797.0	218,900.0	6.7	19,439.0	39,530.0	5.2	63,866.0
	%	100.0	100.0		100.0	100.0		100.0

SOURCES: 1. Final working drafts of MRP Reports:

Greece:	Table 5	(obtained from the Division of Economic Planning, Ministry of Co-ordination, Athens)
Italy:	Table 21	(obtained from "Données de l'ISTAT élaborés par la SVIMEZ)
Spain	Table 38	(obtained from Spanish National Accounts, Ministry of Finance)
Turkey	Table 4	(obtained from "Economic Surveys by the OECD - Turkey", OECD May 1963)
	Table 6	(based on output figures in the Development Plan)
Yugoslavia:	Table II and Table III of the appendix to Chapter IV.	

2. Other sources:

Portugal:	"Statistics of National Accounts, 1955-1962 Supplement", OECD, April 1964
Turkey:	First Five Year Development Plan 1963-1967, State Planning Organisation, Republic of Turkey.

NOTES: a) Gross Domestic Product at factor cost.

b) In MRP Report these figures were labelled as follows: Gross National Product at factor cost, account taken of sectoral overlap. The sectoral figures cited are the same as those appearing in Table I (Statistical Annex) Economic Surveys by the OECD - Italy, February 1963, which are labelled Gross Domestic Product at factor costs including sectoral overlap.

P COUNTRIES: BASE YEAR AND TARGET YEAR

In national currencies

10^9 PESETAS AT 1960 PRICES			10^6 TURKISH LIRA AT 1961 PRICES			10^6 DINARS AT 1962 PRICES		
SPAIN[a]			TURKEY			YUGOSLAVIA		
BASE YEAR 1960	TARGET YEAR 1975	AVERAGE ANNUAL % CHANGE 1960-75	BASE YEAR 1962[e]	TARGET YEAR 1977[e]	AVERAGE ANNUAL % CHANGE 1962-77	BASE YEAR 1960	TARGET YEAR 1975	AVERAGE ANNUAL % CHANGE 1960-75
142.8 26.4	213.7 16.5	2.7	18,367.2 39.1	31,958.9 22.5	3.8	1,055.0 28.1	2,228.7 15.4	5.1
11.1 2.1	22.6 1.7	4.9	986.5[f] 2.1	3,442.9[f] 2.4	8.7	.. [g] ..	.. [j] ..	.. [j] ..
124.4 23.1	392.9 30.4	8.0	7,093.2[g] 15.1	29,862.4[g] 21.0	10.1	1,414.0[jk] 37.6	6,815.7[jk] 47.0	11.1
25.1 4.6	101.8 7.9	9.8	2,724.6[f] 5.8	11,470.6 8.1	10.1	216.0 5.8	1,000.0 6.9	10.8
13.6 2.5	48.1 3.7	8.8	.. [f] ..	.. [f] ..	.. [f] ..	71.0 1.9	321.4 2.2	10.6
74.2 32.3	565.4 43.7	8.2	10,804.3 23.0	44,775.9 31.5	9.9	1,701.0 45.3	8,137.1 56.1	11.0
75.9 14.1	166.1 12.8	5.4	7,469.0[h] 15.9	27,485.9[h] 19.3	9.1	418.0[l] 11.1	1,528.4[l] 10.6	9.0
36.8 6.8	84.5 6.5	5.7	3,194.3 6.8	11,755.0 8.3	9.1	240.0 6.4	1,043.2 7.2	10.3
10.0 20.4	263.6 20.4	6.0	7,140.2[i] 15.2	26,275.0[i] 18.4	9.1	341.4[m] 9.1	1,552.5[m] 10.7	10.6
22.7 41.3	514.2 39.8	5.7	17,803.5 37.9	65,516.8 46.0	9.1	999.4 26.6	4,124.1 28.5	9.9
39.7 00.0	1,293.3 100.0	6.0	46,975.0 100.0	142,251.6 100.0	7.7	3,755.4 100.0	14,489.9 100.0	9.4

The MRP Report for Portugal gives GNP at factor cost for 1958 at 1954 prices. The corresponding data on employment is given for 1960. In order to make the two comparable, GNP at factor cost for 1960 at current prices has been used. No projections were were made for 1975 in the MRP Report.

"Construction" is included with "Manufacture".

MRP Table 4 industry origin proportions of Domestic Income were applied to GDP at factor cost derived from Table 2 (Statistical Annex) Economic Surveys by the OECD - Turkey, May 1964. Figures for 1977 were derived by applying output indices (MRP Table II.6) to base year figures.

"Electricity, gas and water" is included with "Mining".

MRP Table 4 does not separate Mining and Manufacturing. Division was obtained by taking manufacturing value added from Development Plan Table 85 and attributing residual to mining.

Includes "private services".

Includes "ownership of dwelling".

"Mining" is included with "Manufacture".

Includes "arts and crafts" in the socialist sector.

Includes "arts and crafts" in the private sector.

Comprises the difference between special product as defined in the Yugoslav MRP Report and the OECD estimates based on the assumptions made by the OECD Surveys as regards the conversion of social product to Gross Domestic Product on OECD definitions.

Table K. GROSS DOMESTIC PRODUCT BY SECTOR OF ORIGIN*

(million US $ at official rates of exchange in base year)

	10^6 GREECE[a]		10^6 ITALY[b]		PORTUGAL	SPAIN[a]		TURKEY		YUGOSLAVIA	
	1961	1974	1961	1975	1960[c]	1960	1975	1962[e]	1977[e]	1960	1975
Agriculture	946.7	1,446.7	5,309.2	7,004.8	563.5	2,380.0	3,561.7	2,040.8	3,551.0	1,406.7	2,971.6
Mining	37.2	125.0	334.9	805.2	14.7	185.0	376.7	109.6[f]	382.5[f]	..	..
Manufacture	572.5	1,754.7	10,188.4	26,280.2	835.2[d]	2,073.3	6,548.3	788.1[g]	3,318.0[g]	1,885.3[jk]	9,087.6[jk]
Construction	176.3	515.3	2,262.5	5,829.3	..[d]	418.3	1,696.7	302.7	1,274.5	288.0	1,333.3
Electricity, gas, water	49.2	231.7	848.6	2,334.9	55.6	226.7	801.7	..	..	94.7	428.5
Industry total	835.2	2,626.7	13,634.4	35,249.6	905.5	2,903.3	9,423.3	1,200.5	4,975.1	2,268.0	10,849.5
Trade, banks and insurance	434.2	999.3	4,006.4	6,731.1	222.3	1,265.0	2,768.3	829.9[h]	3,054.0[h]	557.3[l]	2,037.9[l]
Transport, communications	243.1	606.0	2,143.3	3,800.3	124.1	613.3	1,408.3	354.9	1,306.1	320.0	1,390.9
Government and other services	667.4	1,618.0	6,209.3	10,869.6	409.9	1,833.3	4,393.3	793.4[i]	2,919.5[i]	455.2[m]	2,070.0[m]
Services total	1,344.7	3,223.3	12,359.0	21,401.0	756.3	3,711.7	8,570.0	1,978.2	7,279.6	1,332.5	5,498.8
TOTAL	3,126.6	7,296.7	31,302.7	63,655.4	2,225.3	8,995.0	21,555.0	5,219.4	15,805.7	5,007.2	19,319.9

* See footnotes to table J.

Table L. EMPLOYMENT BY MAJOR DIVISIONS OF ECONOMIC ACTIVIT

MAJOR DIVISIONS OF ECONOMIC ACTIVITY		GREECE			ITALY			PORTUGAL
		BASE YEAR 1961	TARGET YEAR 1974	AVERAGE ANNUAL % CHANGE 1961-74	BASE YEAR 1961	TARGET YEAR 1975	AVERAGE ANNUAL % CHANGE 1961-75	BASE YEAR 1960
Agriculture		1,725.0	1,400.0		5,800.0	4,000.0		1,540.0
	%	50.7	37.8	-1.6	29.9	18.4	-2.7	44.9
Mining		22.0	35.0	3.6	150.0	180.0	1.3	25.0
	%	0.7	0.9		0.8	0.8		0.7
Manufacture		510.5	710.0	2.6	5,110.0	6,420.0	1.6	711.0
	%	15.0	19.2		26.3	29.6		20.8
Construction		124.0	173.0	2.6	1,930.0	2,460.0	1.7	212.0
	%	3.7	4.7		9.9	11.3		6.2
Electricity, gas and water		18.5	32.0	4.3	110.0	140.0	1.7	14.0
	%	0.5	0.9		0.6	0.7		0.4
Industry total		675.0	950.0	2.7	7,300.0	9,200.0	1.7	962.0
	%	19.9	25.7		37.6	42.4		28.1
Trade, banks and insurance		310.1	430.0	2.5	2,550.0	3,300.0	1.9	284.1
	%	9.1	11.6		13.2	15.2		8.3
Transport and communications		194.2	300.0	3.4	1,150.0	1,500.0	1.9	136.5
	%	5.7	8.1		5.9	6.9		4.0
Government and other services		495.7[a]	620.0[a]	1.7	2,600.0	3,700.0	2.6	504.4
	%	14.6	16.8		13.4	17.1		14.7
Services total		1,000.0	1,350.0	2.3	6,300.0	8,500.0	2.2	925.0
	%	29.4	36.5		32.5	39.2		27.0
Total		3,400.0	3,700.0	$0.\bar{7}$	19,400.0	21,700.0	0.8	3,427.0
	%	100.0	100.0		100.0	100.0		100.0

SOURCES: Final working drafts of MRP Reports

Greece:	Table 6	(obtained from the Division of Economic Planning, Ministry of Co-ordination, Athens)
Italy:	Table 22	(obtained from SVIMEZ estimates)
Portugal:	Table L.2, Tables B.7 and B.8	(obtained from "Enquête sur la main-d'œuvre" (OEEC, 1961)
Spain:	Table 40	(obtained from the National Institute of Statistics, 1960 Census)
Turkey:	Table 7	(obtained from the Turkish MRP Team)
Yugoslavia:	Table 60, Table 62 and Table VII of Appendix to Chapter IV.	

RP COUNTRIES: BASE YEAR AND TARGET YEAR (Thousands)

SPAIN			TURKEY			YUGOSLAVIA		
BASE YEAR 1960	TARGET YEAR 1976	AVERAGE ANNUAL % CHANGE 1960-75	BASE YEAR 1962	TARGET YEAR 1977	AVERAGE ANNUAL % CHANGE 1962-77	BASE YEAR 1960	TARGET YEAR 1975	AVERAGE ANNUAL % CHANGE 1960-75
4,803.3 41.3	3,713.4 27.4	-1.7	9,100.0 76.3	9,200.0 54.3	0.1	4,468.0 61.9	3,459.0 41.6	-1.7
203.5 1.7	220.3 1.6	0.5	80.0 0.7	170.0 1.0	5.2	..[d] ..	..[d] ..	..
2,545.9 21.9	3,489.4 25.7	2.1	915.0 7.7	1,950.0 11.5	5.2	1,295.0[de] 18.0	2,380.0[de] 28.6	4.2
822.1 7.1	1,244.9 9.2	2.8	305.0 2.5	1,090.0 6.4	8.9	276.0 3.8	497.0 6.0	4.0
80.8 0.7	123.0 0.9	2.8	.. ..	.. ..	..	49.0 0.7	102.0 1.2	5.0
3,652.3 31.4	5,077.6 37.4	2.2	1,300.0 10.9	3,210.0 18.9	6.2	1,620.0 22.5	2,979.0 35.8	4.2
945.2 8.1	1,502.5 11.1	3.1	.. ..	.. ..	..	414.0[f] 5.7	533.0[f] 6.4	1.7
536.5 4.6	809.0 6.0	2.8	.. ..	.. ..	..	219.0 3.0	515.0 6.2	5.9
1,696.7[a] 14.6	2,461.6[a] 18.1	2.5	.. ..	.. ..	..	494.0 6.9	832.0 10.0	3.5
3,178.4 27.3	4,773.1 35.2	2.7	1,520.0 12.8	4,550.0 26.8	7.6	1,127.0 15.6	1,880.0 22.6	3.5
11,634.0 100.0	13,564.3 100.0	1.0	11,920.0[c] 100.0	16,960.0[c] 100.0	2.4	7,215.0 100.0	8,318.0 100.0	1.0

NOTES:
a) Includes the armed forces.
b) The figures in MRP Report Table B.7 do not cover the whole services sector. In order to estimate the detailed breakdown by subdivision, the proportions obtained through the partial survey have been applied to the total services figure in MRP Report Table I.2.
c) Excludes approximately 661,000 employed persons in the base year not classified by divisions of economic activity. Projections for 1977 do not take into account unclassified persons.
d) "Mining" is included with "Manufacture".
e) Includes employment in "arts and crafts" in the socialist sector.
f) Includes active population in "arts and crafts" in the private sector.

Table M. PRODUCTIVITY TRENDS BY MAJOR DIVISIONS OF

MAJOR DIVISIONS OF ECONOMIC ACTIVITY	10^3 DRACHMAE AT 1961 PRICES			10^6 LIRE AT 1961 PRICES			106 ESCUDOS AT 1960 PRICE
	GREECE			ITALY			PORTUGAL
	BASE YEAR 1961	TARGET YEAR 1974	AVERAGE ANNUAL % CHANGE 1961-74	BASE YEAR 1961	TARGET YEAR 1975	AVERAGE ANNUAL % CHANGE 1961-75	BASE YEAR 1960
Agriculture	16.5	31.0	5.0	0.568	1.088	4.8	10.5
Index[a]	59.8	52.4		56.7	59.7		56.5
Mining	50.7	107.1	5.9	1.386	2.778	5.1	16.9
Index[a]	183.7	180.9		138.0	152.5		90.9
Manufacture	33.6	74.1	6.3	1.238	2.542	5.3	26.0[b]
Index[a]	121.7	125.2		123.6	139.5		139.8
Construction	42.7	89.4	6.2	0.728	1.472	5.2	.. [b]
Index[a]	154.7	151.0		72.7	80.8		..
Electricity, gas and water	79.8	217.2	8.0	4.791	10.357	5.7	113.9
Index[a]	289.1	366.9		478.1	568.4		612.4
Industry total	37.1	82.9	6.4	1.160	2.379	5.3	27.0
Index[a]	134.4	140.0		115.8	130.6		145.2
Trade, banks and insurance	42.0	69.7	4.0	0.976	1.267	1.9	22.5
Index[a]	152.2	117.7		97.4	69.5		121.0
Transport and communications	37.5	60.6	3.8	1.157	1.573	2.2	26.1
Index[a]	135.9	102.4		115.5	86.3		140.3
Government and other services	40.4	78.3	5.2	1.483	1.824	1.5	23.3
Index[a]	146.4	132.3		148.0	100.1		125.3
Services total	40.3	71.6	4.5	1.218	1.564	1.8	23.5
Index[a]	146.0	120.9		121.6	85.8		126.3
Total	27.6	59.2	6.0	1.002	1.822	4.4	18.6
Index	100.0	100.0		100.0	100.0		100.0

SOURCES: 1. Final working drafts of MRP Reports:

Greece: Table 46 (obtained from the Division of Economic Planning, Ministry of Co-ordination, Athens)

Italy: Table 23 (obtained from SVIMEZ estimates)

Spain: Table 39 (obtained from Spanish National Accounts, Ministry of Finance; National Institute of Statistics, 1960 Census)

2. Other sources:

Portugal, Turkey, Yugoslavia: Figures calculated from Tables J and L. See sources and relevant footnotes to these tabl

CONOMIC ACTIVITY, MRP COUNTRIES: BASE YEAR AND TARGET YEAR

In national currencies

10^6 PESETAS AT 1960 PRICES			10^3 TURKISH LIRA AT 1961 PRICES			10^6 DINARS AT 1962 PRICES		
SPAIN			TURKEY			YUGOSLAVIA		
BASE YEAR 196	TARGET YEAR 1975	AVERAGE ANNUAL % CHANGE 1960-75	BASE YEAR 1962	TARGET YEAR 1977	AVERAGE ANNUAL % CHANGE 1962-77	BASE YEAR 1960	TARGET YEAR 1975	AVERAGE ANNUAL % CHANGE 1960-75
0.0297 4.0	0.0575 60.3	4.5	2.018 51.2	3.474 41.4	3.7	0.236 45.4	0.644 37.0	6.9
0.0545 7.5	0.1026 107.7	4.3	12.331[c] 312.9	20.252[c] 241.5	3.4[c]	.. [d] ..	.. [d] ..	.. [d]
0.0489 5.4	0.1126 118.2	5.7	7.752 196.7	15.314 182.6	4.6	1.092[d] 210.0	2.864[d] 164.4	6.6[d]
0.0305 5.7	0.0818 85.8	6.8	8.933 226.7	10.524 125.6	1.1	0.783 150.6	2.012 115.5	6.5
0.1683 2.7	0.3911 410.4	5.8	.. [c]	.. [c]	.. [c]	1.449 278.6	3.147 180.6	5.3
0.0477 2.8	0.1113 116.5	5.8	8.311 210.9	13.949 166.3	3.5	1.050 201.9	2.731 156.8	6.6
0.0803 3.1	0.111 116.5	2.2	.. ..	.. ..	..	1.010 194.2	2.867 164.6	7.2
0.0686 7.8	0.1043 109.1	2.8	.. ..	.. ..	..	1.096 210.8	2.026 116.3	4.2
0.0648 9.7	0.1071 112.3	3.4	.. ..	.. ..	..	0.691 132.9	1.866 107.1	6.8
0.0701 1.1	0.1077 113.3	2.9	11.713 297.2	14.399 171.7	1.4	0.887 170.6	2.194 125.9	6.2
0.0464 0.0	0.0953 100.0	4.9	3.941 100.0	8.387 100.0	5.2	0.520 100.0	1.742 100.0	8.4

TES: a) Index shows productivity in each sector as proportion of average productivity for the whole economy.
b) "Construction" is included with "Manufacture".
c) "Electricity, gas and water" is included with "Mining".
d) "Mining" is included with "Manufacture".

Table II. OCCUPATIONAL COEFFICIENTS - NUMBE
SECTORAL CONTRIBUTIO

DIV. OF ECONOMIC ACTIVITY / OCCUPATIONAL CATEGORY	AGRICULTURE				MINING				MANUFACTURING				CONSTRUCTION				ELECTRICITY, GAS, WATER			
	S	G	P	I	S	G	P	I	S	G	P[b]	I	S	G	P[a]	I	S	G	P	I
Scientific and technical professional workers	2.0[e]	2.2	1.6[e]	3.3[f]	8.6	5.4	6.8[e]	4.5[f]	9.2	3.1	5.6[e]	9.0[f]	16.7	18.7	..	9.4[f]	12.8	14.2	7.2[e]	2
Other professional workers	.. [c]	0.3	.. [e]	.. [f]	5.4	8.1	.. [e]	.. [f]	7.4	5.4	.. [e]	.. [f]	1.9	..	..	.. [f]	0.9	2.0	.. [e]	.
Administrative, executive and managerial workers	..	0.1	-	- [f]	6.5	2.7	6.8	.. [f]	23.3	10.8	9.9	.. [f]	16.7	0.6	..	.. [f]	2.6	2.0	3.6	.
Technical and related workers	.. [e]	0.5	0.4	4.4	7.6	...	6.8	4.8	6.8	5.4	2.9	17.6	9.8	45.9	..	28.2	5.7	18.3	5.4	18
Clerical and sales workers	4.0	-	1.6	-	46.5	61.8	68.0	8.4	116.7	110.0	52.4	23.6	99.2	18.1	..	15.3	67.9	73.2	41.4	23
Farmers, cattle breeders, fishermen	2,012.2	1,819.0	2,729.6	1,084.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total workers (i, ii and iii)	-	-	-	-	1,025.4	513.4	1,611.8	430.2	1,064.6	756.9	1,034.1	451.4	1,821.8	619.9	..	800.2	266.9	268.3	194.3	85
i. Skilled workers	-	-	-	-	308.1	13.4	74.8	1.8	307.0	356.7	35.0	4.5	528.5	282.0	..	40.9	112.1	81.3	10.8	4
ii. Semi-skilled workers	-	-	-	-	230.8	258.1	176.8	352.3	385.6	215.4	291.4	333.5	255.5	..	..	128.8	46.8	6.1	73.8	48
iii. Unskilled workers	-	-	-	-	486.5	241.9	1,360.2	76.1	372.0	184.[illegible]	707.7	113.5	1,037.7	337.8	..	630.4	108.1	183.9	109.8	32
TOTAL	2,018.2	1,822.2	2,733.2	1,092.5	1,100.0	591.4	1,700.2	447.8	1,228.0	881.6	1,105.0	501.6	1,965.2	703.2	..	853.0	356.9	378.1	351.9	12

G : GREECE
I : ITALY
P : PORTUGAL
S : SPAIN

OCCUPATION IN SECTOR PER $US 1,000,000
GDP - BASE YEAR

INDUSTRY TOTAL				TRADE, BANKS, INSURANCE				TRANSPORT, COMMUNICATIONS				GOVERNMENT AND OTHER SERVICES				SERVICES TOTAL				TOTAL			
S	G	P	I	S	G	P	I	S[b]	G	P	I	S[b]	G[b]	P	I	S[b]	G[b]	P	I	S[b]	G[b]	P	I
0.5	7.2	5.7[e]	8.6[f]	2.8	8.8	11.7[e]	48.5[f]	4.4	2.1	7.3[e]	10.7[f]	44.7	24.6	24.6[e]	100.4[f]	23.8	15.4	18.0[e]	67.4[f]	13.7	9.2	8.8[e]	30.9[f]
6.0	4.2	..[e]	..[f]	0.9	14.5	..[e]	..[f]	1.8	2.1	..[e]	..[f]	140.6	109.2	..[e]	..[f]	70.2	59.3	..[e]	..[f]	30.9	28.7	..[e]	..[f]
9.7	7.8	9.5	..[f]	21.0	6.4	36.9	..[f]	7.8	13.2	7.3	..[f]	17.2	7.9	52.3	..[f]	17.0	8.4	40.3	..[f]	13.4	5.7	17.6	..[f]
7.2	14.5	3.1	19.0	4.9	2.8	3.1	3.3	2.6	53.9	3.2	43.4	27.7	28.0	67.6	44.7	15.8	24.5	38.1	31.1	8.8	14.6	14.3	21.3
5.7	86.3	52.0	21.8	633.8	529.9	720.1	363.3	83.2	33.7	61.2	82.1	119.5	153.4	81.2	52.1	288.8	232.8	265.7	158.2	134.4	131.8	111.9	72.0
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	532.4	550.8	691.1	184.0
6.9	688.3	992.0	486.0	83.6[d]	152.0	506.0	223.3	774.9[d]	694.5	1,020.6	400.3	485.8[d]	269.7	1,004.9	221.5	400.4[d]	308.5	860.8	253.1	523.2	316.5	686.2	311.6
3.8	305.2	34.1	10.5	..	5.3	9.9	0.7	..	30.4	28.8	16.0	..	22.6	4.9	1.8	..	18.4	10.4	4 0	104.5[c]	89.5	17.4	6.2
0.5	159.5	276.2	282.2	..	..	69.7		..	530.7	644.4	119.7	..	58.7	114.9	1.2	..	125.1	188.5	21.3	106.7[c]	96.4	178.5	131.4
4.6	223.7	681.6	193.2	..	168.7	428.4	222.6	..	133.3	348.4	284.0	..	188.3	885.1	218.6	..	164.9	661.6	227.8	168.7[c]	130.7	502.3	174.1
8.0	808.3	1,062.3	535.4	747.1	714.4	1,277.8	636.5	874.7	799.5	1,099.6	536.6	925.5	743.0	1,230.6	418.7	856.3	743.7	1,222.9	509.7	1,294.0	1,087.5	1,540.0	619.8

Table O. OCCUPATIONAL COEFFICIENTS - NUMBER
SECTORAL CONTRIBUTION

DIVISION OF ECONOMIC ACTIVITY / OCCUPATIONAL CATEGORY	AGRICULTURE			MINING			MANUFACTURING			CONSTRUCTION			ELECTRICITY, GAS, WATER		
	S	G	I	S	G	I	S	G	I	S	G	I	S	G	I
Scientific and technical professional workers	2.1	2.6	2.9 (f)	5.3	2.4	6.7(f)	5.9	2.3	10.2(f)	5.9	11.6	25.3(f)	4.6	7.3	3.6
Other professional workers	..	0.6	.. (f)	2.4	3.2	.. (f)	2.1	2.6	.. (f)	1.5	0.2	.. (f)	0.8	0.9	..
Administrative, executive and managerial workers	1.0	0.07	.. (f)	6.4	1.6	.. (f)	14.9	4.4	.. (f)	14.7	0.6	.. (f)	1.6	0.4	..
Technical and related workers	3.1	0.8	8.6	9.8	1.6	11.2	11.2	4.0	28.8	8.8	28.3	46.4	6.6	9.5	9.0
Clerical and sales workers	5.2	-	-	28.7	12.0	13.4	63.9	40.7	20.6	36.7	13.8	21.1	33.8	32.0	9.0
Farmers, cattlebreeders, fishermen	1031.1	964.0	559.8	-	-	-	-	-	-	-	-	-	-	-	-
Total workers (i, ii and iii)	-	-	-	532.4	259.2	192.3	434.6	350.5	184.7	666.2	281.1	329.1	106.1	98.0	38.4
i. Skilled workers	-	-	-	198.9	6.4	11.2	151.3	146.9	9.3	256.8	151.9	25.3	61.4	44.5	3.6
ii. Semi-skilled workers	-	-	-	117.1	140.8	154.3	180.1	113.3	160.5	66.0	..	189.9	15.3	1.7	25.2
iii. Unskilled workers	-	-	-	216.4	112.0	26.8	103.4	90.3	14.9	343.4	129.2	113.9	29.4	51.8	9.6
TOTAL EMPLOYED	1042.5	967.9	571.3	585.0	280.0	223.6	532.8	404.5	244.3	733.8	335.6	421.9	153.3	138.1	60.0

G: GREECE
I: ITALY
S: SPAIN

OCCUPATION IN SECTOR PER $US 1,000,000
GDP - TARGET YEAR

INDUSTRY TOTAL			TRADE, BANKS, INSURANCE			TRANSPORT, COMMUNICATIONS			GOVT. AND OTHER SERVICES			SERVICES - TOTAL			TOTAL		
	G	I	S	G	I	S	G	I	S (h)	G (h)	I	S (h)	G (h)	I	S (h)	G (h)	I
.7	4.6	12.2(f)	3.1	4.9	47.2(f)	2.8	1.3	19.7(f)	21.6	13.8	87.6(f)	12.5	8.7	62.9(f)	7.8	6.0	28.2(f)
.9	2.0	.. (f)	1.9	8.8	.. (f)	2.8	1.8	.. (f)	97.5	58.5	.. (f)	51.1	32.5	.. (f)	21.1	15.2	.. (f)
.4	3.2	.. (f)	19.3	3.8	.. (f)	5.8	8.6	.. (f)	17.1	5.3	.. (f)	15.9	5.5	.. (f)	12.4	3.6	.. (f)
.3	9.2	30.0	5.7	2.1	35.7	5.8	36.8	67.1	26.1	15.8	47.7	16.2	15.5	47.3	11.4	10.3	33.5
.1	32.4	19.7	462.0	342.8	297.7	74.7	25.4	86.8	75.0	86.4	90.8	200.0	154.4	155.2	104.4	79.9	63.1
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	170.4	191.1	61.6
.4	310.3	199.1	50.8(d)	67.8	109.6	482.6(d)	421.2	221.0	288.8(d)	152.1	114.3	243.7(d)	176.6	131.8	294.7(h)	189.7	154.6
.6	132.2	11.6	..	3.8	22.7	..	19.5	23.7	..	11.6	9.3	..	10.8	16.1	71.9(g)	52.3	11.9
.0	82.5	156.3	..	..	..	..	368.5	126.3	..	38.3	64.4	..	88.5	55.1	62.5(g)	68.8	105.1
.8	95.6	31.2	..	64.0	86.9	..	33.2	71.0	..	102.0	40.6	..	77.3	60.6	63.3(g)	68.6	37.6
.8	361.7	261.0	542.8	430.2	490.2	574.5	495.1	394.6	560.3	383.2	340.4	556.9	418.8	397.2	629.3	507.1	340.9

Table P. (cont'd)

OCCUPATION \ SECTOR	AGRICULTURE	MINING	MANU-FACTURE	CONSTRUC-TION	UTILITIES	TRADE, BANKS	TRANSPORT	GOVERNMENT AND OTHER SERVICES (INCL. EDUCATION)	TOTAL CHANGE ALL SECTORS	CHANGE AS REPORTED IN EMPLOYMENT TABLES
Clerical and sales workers:										
due to a	+ 14.36	+ 1.58	+ 84.96	+ 0.06	+ 3.45	+ 3.71	+ 25.07	+ 10.88	+ 144.07	
due to b	- 11.15	- 6.82	- 317.18	- 60.98	- 20.74	- 354.55	- 35.01	- 149.89	- 956.32	
due to c	- 7.89	- 1.75	+ 100.30	+ 31.13	+ 9.08	- 99.94	- 3.52	0	+ 27.41	
due to d	+ 13.68	+ 9.19	+ 308.67	+ 50.99	+ 19.90	+ 928.00	+ 67.70	+ 249.70	+1647.83	
Net change	+ 9.00	+ 2.20	+ 176.75	+ 21.20	+ 11.69	+ 477.22	+ 54.24	+ 110.69	+ 862.99	+ 863.0
Farmers etc.										
due to a	- 38.15	0	0	0	0	0	0	0	- 38.15	
due to b	-3078.85	0	0	0	0	0	0	0	-3078.85	
due to c	-2206.24	0	0	0	0	0	0	0	-2206.24	
due to d	+4205.01	0	0	0	0	0	0	0	+4205.01	
Net change	-1118.23	0	0	0	0	0	0	0	-1118.23	-1116.5
All workers:										
due to a	0	- 5	- 174	- 23	- 6	- 24	- 33	- 40	- 305	
due to b	0	- 137	-2421	-1118	- 71	- 42	- 261	- 595	-4645	
due to c	0	- 35	+ 781	+ 584	+ 32	- 13	- 28	0	+1321	
due to d	0	+ 188	+2451	+ 932	+ 70	+ 113	+ 524	+ 999	+5277	
Net change	0	+ 11	+ 637	+ 375	+ 25	+ 34	+ 202	+ 364	+1648	+1646.2
Change: All occupations:										
due to a	- 0.01	+ 0.16	- 0.62	- 0.04	+ 0.43	- 0.35	- 0.12	+ 61.85	+ 61.30	
due to b	-3101.31	- 148.87	-2892.37	-1221.06	- 99.44	- 416.77	- 303.68	-1054.26	-9237.76	
due to c	-2222.07	- 38.02	+ 928.94	+ 635.25	+ 44.40	- 118.61	- 32.29	0	- 802.40	
due to d	+4231.58	+ 203.74	+2904.36	+1015.44	+ 97.10	+1092.28	+ 606.31	+1757.70	+11908.51	
Net change	-1091.80	+ 17.01	+ 940.31	+ 429.59	+ 42.49	+ 556.55	+ 270.22	+ 765.29	+1929.65	+1930.3
Change as reported in Employment Tables	-1089.9	+ 16.8	+ 943.5	+ 422.8	+ 42.2	+ 557.3	+ 272.5	+ 764.9	+1930.3	
	- 1.9	+ 0.2	- 3.2	+ 6.8	+ 0.3	- 0.8	- 2.3	+ 0.4	- 0.6	

a = number in occupation as % of number in sector.

b = number in sector per unit of output.

c = sector output as % G.D.P.

d = G.D.P.

Table Q.
GREECE: FACTORS OF CHANGE IN OCCUPATIONS BY SECTOR

(employment in thousands)

SECTOR / OCCUPATION	AGRICULTURE	MINING	MANU-FACTURE	CONSTRUC-TION	UTILITIES	TRADE, BANKS	TRANSPORT	GOVERNMENT AND OTHER SERVICES	TOTAL CHANGE ALL SECTORS	CHANGE AS REPORTED IN EMPLOYMENT TABLES
Scientific and technical professional workers:										
due to a	+ 2.43	- 0.01	+ 1.56	+ 1.33	+ 0.46	- 0.36	+ 0.03	+ 1.77	+ 7.21	
due to b	- 2.11	- 0.21	- 2.66	- 3.87	- 1.46	- 2.40	- 0.34	- 14.22	- 27.27	
due to c	- 1.40	+ 0.10	+ 0.86	+ 1.13	+ 0.91	- 0.06	+ 0.05	+ 0.80	+ 2.39	
due to d	+ 2.65	+ 0.23	+ 2.57	+ 4.11	+ 1.09	+ 3.90	+ 0.57	+ 17.54	+ 32.66	
Net change	+ 1.57	+ 0.11	+ 2.33	+ 2.70	+ 1.00	+ 1.08	+ 0.31	+ 5.89	+ 14.99	+ 15.00
Other professional workers:										
due to a	+ 0.69	- 0.07	+ 0.28	+ 0.09	+ 0.03	+ 0.06	+ 0.29	+ 3.44	+ 4.81	
due to b	- 0.42	- 0.30	- 3.46	- 0.04	- 0.18	- 4.16	- 0.41	- 61.49	- 70.46	
due to c	- 0.28	+ 0.14	+ 1.16	+ 0.01	+ 0.12	- 0.11	+ 0.05	+ 3.46	+ 4.55	
due to d	+ 0.50	+ 0.32	+ 3.52	+ 0.04	+ 0.14	+ 6.71	+ 0.67	+ 76.31	+ 88.21	
Net change	+ 0.49	+ 0.09	+ 1.50	+ 0.10	+ 0.11	+ 2.50	+ 0.60	+ 21.72	+ 27.11	+ 27.2
Administrative, executive and managerial workers:										
due to a	+ 0.03	+ 0.04	- 0.88	- 0.15	- 0.07	- 0.08	+ 0.23	+ 1.94	+ 1.36	
due to b	- 0.07	- 0.13	- 6.23	- 0.17	- 0.12	- 1.82	- 2.17	- 5.11	- 15.82	
due to c	- 0.05	+ 0.06	+ 2.12	+ 0.05	+ 0.09	- 0.05	+ 0.29	+ 0.28	+ 2.79	
due to d	+ 0.09	+ 0.13	+ 6.50	+ 0.17	+ 0.10	+ 2.95	+ 3.66	+ 6.18	+ 19.78	
Net change	0	+ 0.10	+ 1.51	+ 0.20	0	+ 1.00	+ 2.01	+ 3.29	+ 8.11	+ 8.1
Technical and related workers:										
due to a	+ 0.49	+ 0.18	+ 2.67	+ 3.13	+ 0.60	+ 0.40	+ 1.82	+ 2.17	+ 11.46	
due to b	- 0.48	- 0.08	- 4.59	- 9.44	- 1.89	- 0.91	- 9.15	- 16.26	- 42.80	
due to c	- 0.32	+ 0.03	+ 1.48	+ 2.75	+ 1.18	- 0.02	+ 1.23	+ 0.91	+ 7.24	
due to d	+ 0.61	+ 0.07	+ 4.43	+ 10.06	+ 1.41	+ 1.43	+ 15.30	+ 20.06	+ 53.37	
Net change	+ 0.30	+ 0.20	+ 3.99	+ 6.50	+ 1.30	+ 0.90	+ 9.20	+ 6.88	+ 29.27	+ 29.3

Table Q. (cont'd)

SECTOR / OCCUPATION	AGRICULTURE	MINING	MANUFACTURE	CONSTRUCTION	UTILITIES	TRADE, BANKS	TRANSPORT	GOVERNMENT AND OTHER SERVICES	TOTAL CHANGE ALL SECTORS	CHANGE AS REPORTED IN EMPLOYMENT TABLES
Clerical and sales workers:										
due to a	0	- 1.94	- 15.55	+ 2.50	- 1.01	+ 21.86	+ 2.41	+ 12.38	+ 20.65	
due to b	0	- 1.63	- 60.23	- 4.28	- 5.34	- 157.77	- 6.08	- 88.67	- 324.00	
due to c	0	+ 0.82	+ 20.60	+ 1.23	+ 3.57	- 4.22	+ 0.81	+ 4.97	+ 27.78	
due to d	0	+ 1.95	+ 63.54	+ 4.45	+ 4.28	+ 252.63	+ 10.06	+ 109.31	+ 446.22	
Net change	0	- 0.80	+ 8.36	+ 3.90	+ 1.50	+ 112.50	+ 7.20	+ 37.99	+ 170.65	+ 170.8
Farmers, etc.										
due to a	- 4	0	0	0	0	0	0	0	- 4	
due to b	-1081	0	0	0	0	0	0	0	-1081	
due to c	- 727	0	0	0	0	0	0	0	- 727	
due to d	+1485	0	0	0	0	0	0	0	+1485	
Net change	- 327	0	0	0	0	0	0	0	- 327	- 327.4
All workers:										
due to a	0	+ 2	+ 12	- 7	0	- 22	- 5	+ 21	+ 1	
due to b	0	- 22	- 469	- 106	- 22	- 37	- 110	- 157	- 923	
due to c	0	+ 10	+ 157	+ 33	+ 14	- 1	+ 14	+ 9	+ 236	
due to d	0	+ 23	+ 482	+ 117	+ 18	+ 62	+ 187	+ 193	+1082	
Net change	0	+ 13	+ 182	+ 37	+ 10	+ 2	+ 86	+ 66	+ 396	+ 394.6
All occupations:										
due to a	- 0.36	+ 0.20	+ 0.08	+ 0.20	+ 0.01	- 0.12	- 0.22	+ 42.70	+ 42.49	
due to b	-1084.08	- 24.35	- 546.17	- 123.80	- 30.99	- 204.06	- 128.15	- 342.75	-2484.35	
due to c	- 729.05	+ 11.15	+ 183.22	+ 38.17	+ 19.87	- 5.46	+ 16.43	+ 19.42	- 446.25	
due to d	+1488.85	+ 25.70	+ 562.56	+ 135.83	+ 25.02	+ 329.62	+ 217.26	+ 422.40	+3207.24	
Net change	- 324.64	+ 12.70	+ 199.69	+ 50.40	+ 13.91	+ 119.98	+ 105.32	+ 141.77	+ 319.13	+ 300.0[b]
Change as reported in Employment Tables	- 325.00	+ 13.00	+ 199.50	+ 49.00	+ 13.50	+ 119.90	+ 105.80	+ 124.3[b] + 17.7[b] + 142.0	+ 300.0[b] + 17.7[b] + 317.7	

a = number in occupation as % of number in sector.
b = number in sector per unit of output.
c = sector output as % of G.D.P.
d = G.D.P.

Table R.

ITALY: FACTORS OF CHANGE IN OCCUPATIONS BY SECTOR

(employment in thousands)

SECTOR / OCCUPATION	AGRICULTURE	MINING	MANU-FACTURE	CONSTRUCTION	UTILITIES	TRADE, BANKS, ETC.	TRANSPORT	GOVERNMENT AND OTHER SERVICES	TOTAL CHANGE ALL SECTORS	CHANGE AS REPORTED IN EMPLOYMENT TABLES
Scientific and technical professional workers:										
due to a	+ 10.63	+ 3.58	+ 148.42	+ 116.92	+ 5.74	+ 71.17	+ 41.59	+ 57.97	+ 456.02	
due to b	- 13.65	- 2.69	- 144.46	- 66.61	- 4.55	- 68.82	- 15.60	- 169.67	- 486.05	
due to c	- 9.10	+ 0.60	+ 44.32	+ 19.94	+ 1.61	- 50.17	- 6.87	- 122.53	- 122.20	
due to d	+ 14.72	+ 2.46	+ 127.05	+ 56.15	+ 3.61	+ 179.38	+ 32.85	+ 563.69	+ 979.91	
Net change	+ 2.60	+ 3.95	+ 175.53	+ 126.40	+ 6.41	+ 131.56	+ 51.97	+ 329.46	+ 827.68	+ 827.5
Technical and related workers:										
due to a	+ 58.46	+ 7.04	+ 519.97	+ 183.65	+ 1.50	+ 206.41	+ 123.45	+ 108.73	+1209.21	
due to b	- 32.88	- 4.15	- 377.82	- 131.41	- 15.59	- 33.55	- 55.55	- 84.96	- 735.91	
due to c	- 21.69	+ 0.91	+ 113.52	+ 40.18	+ 5.98	- 24.27	- 24.53	- 61.29	+ 28.81	
due to d	+ 32.91	+ 3.60	+ 321.81	+ 114.46	+ 13.84	+ 78.01	+ 118.41	+ 278.12	+ 961.16	
Net change	+ 36.80	+ 7.40	+ 577.48	+ 206.88	+ 5.73	+ 226.60	+ 161.78	+ 240.60	+1463.27	+1463.2
Clerical and sales workers:										
due to a	0	+ 7.40	+ 234.34	+ 76.38	- 4.62	+ 111.62	+ 92.83	+ 464.89	+ 982.84	
due to b	0	- 5.30	- 312.83	- 61.88	- 17.60	- 474.24	- 81.29	- 137.44	-1090.58	
due to c	0	+ 1.18	+ 97.57	+ 19.10	+ 6.91	- 346.14	- 36.06	- 98.96	- 356.40	
due to d	0	+ 4.72	+ 282.26	+ 54.69	+ 16.14	+1256.97	+ 178.35	+ 435.03	+2228.16	
Net change	0	+ 8.00	+ 301.34	+ 88.29	+ 0.83	+ 548.21	+ 153.83	+ 663.52	+1764.02	+1764.0
Farmers, cattle breeders, etc.:										
due to a	- 69	0	0	0	0	0	0	0	- 69	
due to b	-3329	0	0	0	0	0	0	0	-3329	
due to c	-2240	0	0	0	0	0	0	0	-2240	
due to d	+3799	0	0	0	0	0	0	0	+3799	
Net change	-1839	0	0	0	0	0	0	0	-1839	-1839.4

Table R. (cont'd)

SECTOR / OCCUPATION	AGRICULTURE	MINING	MANU-FACTURE	CONSTRUC-TION	UTILITIES	TRADE, BANKS, ETC.	TRANSPORT	GOVERNMENT AND OTHER SERVICES	TOTAL CHANGE ALL SECTORS	CHANGE AS REPORTED IN EMPLOYMENT TABLES
All workers:										
due to a	0	- 18	- 904	- 377	- 4	- 392	- 258	- 631	-2584	
due to b	0	- 116	-3743	-1440	- 70	- 226	- 276	- 291	-6162	
due to c	0	+ 28	+1240	+ 483	+ 28	- 163	- 124	- 204	+1288	
due to d	0	+ 118	+3661	+1442	+ 63	+ 624	+ 639	+ 995	+7542	
Net change	0	+ 12	+ 254	+ 108	+ 17	- 157	- 19	- 131	+ 84	+ 84.7
All occupations:										
due to a	+ 0.09	+ 0.02	- 1.27	- 0.05	- 1.38	- 2.80	- 0.13	+ 0.59	- 4.93	
due to b	-3375.53	- 128.14	-4578.11	-1699.90	- 107.74	- 802.61	- 428.44	- 683.07	-11803.54	
due to c	-2270.79	+ 30.69	+1495.41	+ 562.22	+ 42.50	- 583.58	- 191.46	- 486.78	-1401.79	
due to d	+3[illegible]6.63	+ 128.78	+4392.12	+1667.30	+ 96.59	+2138.36	+ 968.61	+2271.84	+15510.23	
Net change	-1799.60	+ 31.35	+1308.15	+ 529.57	+ 29.97	+ 749.37	+ 348.58	+1102.58	+2299.97	+2300.0
Change as reported in Employment Tables	-1800.0	+ 30.0	+1310.0	+ 530.0	+ 30.0	+ 750.0	+ 350.0	+1100.0	+2300.0	

a = number in occupation as % of number in sector,
b = number in sector per unit of output,
c = sector output as % G.D.P.
d = G.D.P.

Table S.

ITALY: FACTORS OF CHANGE IN OCCUPATIONS BY SECTOR

(1951 to 1961)

(employment in thousands)

SECTOR / OCCUPATION	AGRICULTURE	MINING	MANU-FACTURE	CONSTRUC-TION	UTILITIES	TRADE, BANKS	TRANSPORT	GOVERNMENT AND OTHER SERVICES (INCL. EDUCATION)	TOTAL CHANGE ALL SECTORS	CHANGE AS REPORTED IN EMPLOYMENT TABLES
Scientific and technical professional workers:										
due to a	+ 4.8	+ 0.2	+ 16.7	- 7.5	+ 0.5	+ 45.7	+ 2.8	+ 116.7	+ 179.9	
due to b	- 7.5	- 2.1	- 48.7	- 13.1	- 0.9	- 29.5	+ 1.2	- 100.4	- 201.0	
due to c	- 5.3	+ 1.2	+ 18.9	+ 11.7	+ 0.1	- 6.8	0	- 136.1	- 116.3	
due to d	+ 10.0	+ 1.0	+ 45.1	+ 12.2	+ 1.0	+ 79.6	+ 8.9	+ 308.1	+ 465.9	
Net change	+ 2.0	+ 0.3	+ 32.0	+ 3.3	+ 0.7	+ 89.0	+ 12.9	+ 188.3	+ 328.5	+ 328.7
Technical and related workers:										
due to a	+ 6.5	+ 1.0	+ 101.0	+ 37.4	+ 9.3	+ 10.0	+ 60.2	+ 224.8	450.2	
due to b	- 10.0	- 1.8	- 76.9	- 24.1	- 5.5	- 1.5	+ 3.2	- 29.6	- 146.2	
due to c	- 7.1	+ 0.9	+ 28.6	+ 18.9	+ 0.8	- 0.3	0	- 40.5	+ 1.3	
due to d	+ 13.2	+ 0.8	+ 67.1	+ 19.8	+ 5.7	+ 3.7	+ 22.7	+ 84.2	+ 217.2	
Net change	+ 2.6	+ 0.9	+ 119.8	+ 52.0	+ 10.3	+ 11.9	+ 86.1	+ 238.9	+ 522.5	+ 522.7
Clerical and sales workers:										
due to a	0	- 1.0	- 2.1	+ 11.2	- 1.3	+ 12.5	- 20.2	- 47.9	- 48.8	
due to b	0	- 4.6	- 139.2	- 15.5	- 10.4	- 263.1	+ 10.4	- 61.6	- 484.0	
due to c	0	+ 2.6	+ 54.7	+ 12.8	+ 1.5	- 60.8	0	- 83.4	- 72.6	
due to d	0	+ 2.2	+ 131.5	+ 13.4	+ 11.7	+ 732.6	+ 79.9	+ 193.3	+1155.6	
Net change	0	- 0.8	+ 44.9	+ 21.9	+ 1.5	+ 412.2	+ 70.1	+ 0.4	+ 550.2	+ 551.3
Farmers, cattlebreeders, fishermen, etc.										
due to a	- 11.2	0	0	0	0	0	0	0	- 11.2	
due to b	-2804.5	0	0	0	0	0	0	0	-2804.5	
due to c	-2002.2	0	0	0	0	0	0	0	-2002.2	
due to d	+3812.9	0	0	0	0	0	0	0	+3812.9	
Net change	-1005.0	0	0	0	0	0	0	0	-1005.0	-1004.6

Table S. (cont'd)

SECTOR OCCUPATION	AGRICULTURE	MINING	MANU-FACTURE	CONSTRUC-TION	UTILITIES	TRADE, BANKS	TRANSPORT	GOVERNMENT AND OTHER SERVICES (INCL. EDUCATION)	TOTAL CHANGE ALL SECTORS	CHANGE AS REPORTED IN EMPLOYMENT TABLES
All workers:										
due to a	0	- 0.3	- 115.5	- 41.1	- 8.5	- 68.3	- 42.7	- 293.6	- 570.0	
due to b	0	- 211.1	-2686.3	- 967.3	- 38.0	- 168.9	+ 48.9	- 269.5	-4292.2	
due to c	0	+ 117.5	+1057.3	+ 836.0	+ 5.7	- 39.1	0	- 364.8	+1612.6	
due to d	0	+ 98.6	+2541.7	+ 875.3	+ 43.1	+ 467.3	+ 373.9	+ 849.0	+5248.9	
Net change	0	+ 4.7	+ 797.2	+ 702.9	+ 2.3	+ 191.0	+ 380.1	- 78.9	+1999.3	+2000.9
All occupations:										
due to a	+ 0.1	- 0.1	+ 0.1	0	0	- 0.1	+ 0.1	0	+ 0.1	
due to b	-2822.0	- 219.6	-2951.1	-1020.0	- 54.8	- 483.0	+ 63.4	- 461.1	-7927.9	
due to c	-2014.6	+ 122.2	+1159.5	+ 879.4	+ 8.1	- 107.0	0	- 624.8	- 577.2	
due to d	+3836.1	+ 102.6	+2785.4	+ 920.7	+ 61.5	+1274.2	+ 485.7	+1434.6	+10900.5	
Net change	-1000.4	+ 5.1	+ 993.9	+ 780.1	+ 14.8	+ 704.1	+ 549.2	+ 348.7	+2395.5	+2400.0
Change as reported in Employment Tables	-1000.0	+ 5.0	+ 995.0	+ 780.0	+ 15.0	+ 705.0	+ 550.0	+ 350.0	+2400.0	

a = number in occupation as % of number in sector.
b = number in sector per unit of output.
c = sector output as % G.D.P.
d = G.D.P.

NOTES TO TABLES H, I, N and O

a) In as far as it has been possible, an effort has been made to get employment figures on a consistent comparative basis for Spain, Greece, Portugal and Italy. Because of the problems arising from the inclusion or exclusion of the armed forces and unemployed persons, this has not always been possible. Where information has been available, estimates for the armed forces have been added to the total in the service sector, even if the corresponding occupational breakdown has not been available.

b) For all four countries, the occupational categories chosen were those presented in the MRP Report of Spain. Thus "Scientific and Technical Professional Workers", "Other Professional Workers", and "Technical and Related Workers" correspond to the major group "O" of the ISCO Classification of occupations. The first two groups mentioned above are as follows:

   1) includes: architects, engineers, land-surveyors; chemists, physicists, biologists, veterinary surgeons, agricultural engineers and similar; physicians, surgeons and dentists;

   2) includes: schoolmasters, teachers and research-workers; priests and comparable members of religious orders; professional and similar workers (accountants, social workers, library workers, archivists, economists, registrars and statisticians). For further details, see "nomenclatura y claves de codificacion para las clasificaciones del censo de poblacion de 1960" (INE). An effort has been made to adapt the classifications of the other three countries as nearly as possible to that used by Spain.

c) Technical Workers and other Professional Workers are included with Scientific and Technical Professional Workers.

d) Information is not available for breakdown between skilled, semi-skilled and unskilled workers in the Services.

e) Other Professional Workers are included with Scientific and Technical Professional Workers, as the Portuguese classification does not distinguish between them.

f) Other Professional Workers and Administrative, Executive and Managerial Workers are included with Scientific and Technical Professional Workers, as sufficiently detailed information is not available to distinguish between them.

g) Excludes all services, for which details are not available [see Note (d)]. Employed in these categories are 1481.0 and 2077.4 in the base and target years respectively.

h) Total includes the armed forces. The breakdown by occupational category is available only for the active civilian population. For this reason, distributed parts do not add up to the total. Percentages are calculated excluding estimates for armed forces.

i) As an estimate of the occupational breakdown for education in 1975 is not available, the same proportional distribution has been used as in 1960.

j) Estimates of employment in Education, other than estimates for Professional and Related Workers, are not available.

k) The total includes an estimate for the armed forces, and a residual of persons for whom a breakdown by occupational category is not available. These items account for approximately 100.5 and 82.8 thousand persons in the base year and target year respectively. Percentages are calculated excluding the estimate for armed forces and unclassified residual.

l) Education is included with Government and Other Services.

m) Refers to teachers only.

n) Construction is included with Manufacture.

Sources: MRP Reports for Spain, Greece, Italy, Portugal also.

Results of the Population and Housing Census of 19th March, 1961. Sample Elaboration, Volume II, Education. National Statistical Service of Greece.

SECOND PART

FIRST NOTE ON THE METHOD OF ANALYSIS PROPOSED IN THE TECHNICAL EVALUATION OF THE MEDITERRANEAN REGIONAL PROJECT*

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1. INTRODUCTION

In the Technical Evaluation of the Mediterranean Regional Project a method is proposed by which a complex variation is developed into the product of changes of more simple factors. Called the analyses of factors of change, it is presented in relation to the explanation of the change in the occupational groups.[1] Further on, the principles of that method are applied in a somewhat different way to measure the influence of manpower requirements on the change in the educational level and structure of the labour force.[2]

The purpose of this note is to comment on the scope of this kind of method, propose some improvements in the equations used, and apply it to Japanese and Italian figures.

2. GENERAL REMARKS ON THE METHOD

In order to avoid any misunderstanding of the scope of this method, it may be worth while to make some - perhaps quite obvious - observations:

i) There is no conflict whatsoever between this kind of method and the research by means of regression analysis - or any other econometric device - of the relationships between the variation being considered and some economic or other explanatory variable. They could be used alternatively or - still better, in our opinion - successively, if statistical analysis is applied in order to explain the variation of each dissociated factor.

The method based on identities is more limited in the choice of the different explanatory factors by the way each factor can be derived from the other (percentage structure, technical coefficients, etc.) and all of them from an initially changing basic variable. However, results are also of a different nature and the only source of uncertainty comes from the interaction terms (their allocation between factors is ignored and must be subject to some more or less arbitrary assumption).

ii) The type of factors selected are subject to some conditions: they should be of a more simple nature than the variable explained and, at the same time, serve the special purpose of the exercise, they should be possible in terms of the identity linking them; they should not be so numerous as to generate a number of interaction factors too difficult to handle (they are as numerous as the combinations of factors chosen).

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1. Pages 41-47 and Appendix III of the Technical Evaluation.
2. Ibid, pages 47-58 and Appendix IV.

iii) There is some interest in proceeding by stages so as to dissociate in further steps the factors that have appeared influential in the first stage.

iv) Although this method allows separation of the influence of different factors it does not indicate complete independence among them. Variables thus dissociated could as well be independent, interdependent, causally connected, related by some common causal variable, etc. To determine the actual relationship is the task of subsequent stages of statistical analysis.

3. PROPOSED VARIATIONS

The equations shown in the Appendix IV of the Technical Evaluation will be reformulated in order to propose some changes.

3.1. Notations used

The following notation is used:[1]

$\vec{E}^t$: (row vector): The distribution of labour force by educational level in year t, in absolute numbers.

L^t: (scalar): Total labour force in year t.

$\vec{O}^t$: (row vector): Percentage distribution of the labour force by occupation in year t.

M^t: (matrix): Horizontal percentage distribution by educational level of labour force in each occupation in year t. Each row is an occupation; each column is an educational level. Each row adds up to 100%.

From it, the following identity can be easily derived:

$$\vec{E}^t = L^t \, \vec{O}^t \, [M^t]$$

The method tries to explain the change in $\vec{E}$, as a result of changes in each of the variables L, $\vec{O}$ and [M].

To make the presentation easier, the equation of change in E will be directly referred to the data that are going to be used in the Janapese example. These are, respectively, L^{50}, $\vec{O}^{50}$, $[M]^{50}$, L^{60} and $[M]^{60}$. The source and manipulation they underwent will be explained later on.

To simplify further, we shall call:

$\vec{E} = \vec{E}^{50}$ $\qquad$ $\Delta \vec{E} = \vec{E}^{60} - \vec{E}^{50}$

$L = L^{50}$ $\qquad$ $\Delta L = L^{60} - L^{50}$

$\vec{O} = \vec{O}^{50}$ $\qquad$ $\Delta \vec{O} = \vec{O}^{60} - \vec{O}^{50}$

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[1] A similar notation as that of the Technical Evaluation was maintained when possible.

$[M] = [M]^{50}$ $\qquad\qquad$ $[\Delta M] = [M]^{60} - [M]^{50}$

It follows that:

$$\vec{E}^{60} = \vec{E} + \Delta \vec{E}$$

$$L^{60} = L + \Delta L$$

$$\vec{O}^{60} = \vec{O} + \Delta \vec{O}$$

$$[M]^{60} = [M] + [\Delta M]$$

so that time superscripts are eliminated.

3.2. The main equation

Equations corresponding to years 1950 and 1960 are respectively:

$$\vec{E} = L \vec{O} \quad M \tag{3}$$

$$E + \Delta \vec{E} = (L + \Delta L)\ (\vec{O} + \Delta \vec{O})\ ([M] + [\Delta M]) \tag{4}$$

Subtracting (3) from (4):

$$\Delta\vec{E} = (L + \Delta L)\ (\vec{O} + \Delta\vec{O})\ ([M] + [\Delta M]) - L\,\vec{O}\,[M] \tag{5}$$

Developing and simplifying:

$$\begin{aligned} \Delta\vec{E} = {} & \Delta L\ \vec{O}\ [M] + L\Delta\vec{O}\ [M] + L\ \vec{O}\ [\Delta M] \\ & + \Delta L \Delta\vec{O}\ [M] + \Delta L\ \vec{O}\ [\Delta M] + L\Delta\vec{O}\ [\Delta M] \\ & + \Delta L\,\Delta\vec{O}\ [\Delta M] \end{aligned} \tag{6}$$

Equation (6) explains the change in the educational level of the labour force, through changes in the other variables. These changes are considered in seven terms, presented in three separate rows to make them clearer.

i) In the first row there appear the three terms in which only one factor changes. They represent the pure variation due to each of them.

ii) In the second row there are three terms in which two factors at a time change simultaneously. They are interaction terms.

iii) In the third row there is one term accounting for the triple interaction between the three factors at one time.

3.3. The results

Since one is interested in the change to be attributed to each of the three chosen factors, the results will be the more precise the more important are the terms of pure variations relative to E.

When interaction terms become of significant magnitudes, conclusions of the analysis are subject to some assumption made concerning their distribution between the intervening factors, as such results share the error contained in the hypothesis used. In the Technical Evaluation, while commenting on the analysis of sources of change, an equal distribution of

3

each term among changing factors involved is proposed. Instead of distributing them equally, one might also distribute them according to the amount of pure variation shown by each factor - that is to say, taking the elements of the first row as the weighting figures. This might be a more satisfying procedure, although there are also good arguments against it, e.g. the non reversibility of the results with an index-type of analysis and the fact that the arbitrary nature of this weighting scheme lies in the necessary influence of the relative size of the pure terms on the relative shares in the interaction terms.

3.4. Differences with the Technical Evaluation

This brief development has brought up some differences with the method proposed in the main document:

i) It is proposed as a first step to eliminate the effect of the growth of the labour force, on the grounds that the part of the change in the education of the labour force that consists in keeping pace with the growth of the population should not be considered as the result of manpower requirements. The rest of the equation is retained at least in the example considered.[1]

The arguments for this choice are questionable. L is a complex factor and, depending on which concept is chosen, it can include not only demographic factors such as the growth of population, but also other, more socio-economic variables, such as activity rates, employment rates, etc. These last elements have more things in common with $\vec{O}$ and $[M]$ than with the demographic factors with regard to questions like identification of supply and demand and the approach to planning.

Even if we accept this first step proposed in the Technical Evaluation, there are some observations on the manipulations made with the equation. The technique proposed in order to eliminate this factor is to keep L constant at the base year level. However, the equations used indicate that the constant level of the end year was chosen.[2] Both techniques are traditionally employed in such index-number problems but they yield different results. Neither of them solves the problem of the interaction between the factor left constant and the other variables. Strangely enough this problem evoked in the preceding section of the main document was not dealt with in this part. To keep its same notation as far as possible:

Change due to population growth

$$\begin{aligned} \Delta\vec{E}^{*} &= (L + \Delta L)\,\vec{O}\,[M] - L\,\vec{O}\,[M] \\ &= \Delta L\,\vec{O}\,[M] \end{aligned} \tag{7}$$

Change due to manpower requirements:

$$\begin{aligned} \Delta\vec{E}^{r} &= \Delta\vec{E} - \Delta\vec{E}^{*} = (L + \Delta L)\,\left[(\vec{O} + \Delta\vec{O})\,([M] + \Delta M) - \vec{O}[M]\right] \\ &= L\Delta\vec{O}\,[M] + L\,\vec{O}[\Delta M] + \\ &\quad + \Delta L\Delta\vec{O}\,[M] + \Delta L\,\vec{O}[\Delta M] + L\Delta\vec{O}[\Delta M] + \\ &\quad + \Delta L\,\Delta\vec{O}[\Delta M] \end{aligned} \tag{8}$$

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1. Page 48 of the Technical Evaluation.
2. Ibid., page [illegible] and Appendix IV.

The only term that disappeared from the equation (6) is - as might have been expected - $\Delta L \ \vec{O}\,[M]$. In the second and third rows of equations (8) we can find three terms where L appears in interaction with the change in other factors. So if the purpose is to eliminate the effect of variable L, any assumption about the distribution of interactions, as already proposed, would be more advisable than leaving them all inside.

It is interesting to develop this line of reasoning in order to see what happens to these terms in the second step proposed in the main document: the separation of the effects due to the occupational variable and those due to the change in education associated with each occupation.

The effects due to occupation are defined:

$$\Delta\vec{E}^{+} = (L + \Delta L)\Delta\vec{O}[M] = L\Delta\vec{O}\,[M] + \Delta L\Delta\vec{O}\,[M] \qquad (9)$$

The effects due to the occupational/educational matrix change are:

$$\vec{E}^{\cdot\cdot} = (L + \Delta L)\,\vec{O}\,[\Delta M] = L\ \vec{O}\,[\Delta M] + \Delta L\ \vec{O}\,[\Delta M] \qquad (10)$$

Interaction is defined as the residual:

$$\Delta\vec{E}^{r} - \Delta\vec{E}^{+} - \Delta\vec{E}^{\cdot\cdot} = (L + \Delta L)\ \Delta\vec{O}\,[\Delta M] = L\Delta\vec{O}\,[\Delta M] + \Delta L\,\Delta\vec{O}\,[\Delta M] \qquad (11)$$

In fact we can see that $\Delta\vec{E}^{+}$ includes also the interaction between L and $\vec{O}$, that a similar term for L and [M] is in $\Delta\vec{E}^{\cdot\cdot}$, and the residual called interaction covers only the one between $\vec{O}$ and [M] and the triple interaction among L, $\vec{O}$ and [M], and leaves all the others out.

ii) Another difference with the Technical Evaluation process is that here we have refrained from calling the joint effect of $\vec{O}$ and [M] the impact of manpower requirements. Apart from what we said at the beginning of (i) it is apparent that [M] reflects also what is called the social demand for education which is acknowledged in the main document. It can be said, too, that changes in the relative scarcity of labour force with different levels of education, as a consequence of social demand, might also influence $\vec{O}$ through supply effects affecting the equilibrium conditions. $\vec{E}$ is then the result of a confrontation of demand and supply of qualified workers, and at this stage it would be dangerous to jump to conclusions on the effect of manpower requirements.

The method used in the Technical Evaluation however show a most interesting road to explore and provide a stimulating presentation of the problems involved.[1]

3.5. A case of inadequate information

Applying the analysis by means of the method proposed in the Technical Evaluation (with the modifications of the last sections) requires full information on L, $\vec{O}$, [M], $L + \Delta L$, $\vec{O} + \Delta\vec{O}$ and $[M] + [\Delta M]$ in order to explain $\Delta\vec{E}$.

The attempt to apply the method to the Italian case[2] brings up a very interesting situation: the lack of information on $[M]$. What can be done when the link between occupation and education is unknown for the base year ? The interest in this case derives from the fact that although the knowledge of $[M]$ and $([M]+[\Delta M])$ all at the same time is an uncommon situation, recent improvements in national statistics normally allow one to know $[M]+[\Delta M]$ alone. Historical data on total labour force and the occupational structure are more easily found. So this makes the Italian case a typical case of availability of information. If the method could be adapted to it, the uncertainties introduced would be largely compensated for by the wider applicability and comparison possibilities.

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[1] See page 159. Second Note on the Variations of the Educational Stock of the active Population. Second stage of the analysis of change factors.

[2] See pages 55-58 and Appendix IV pages 93-94 of the Technical Evaluation.

The Technical Evaluation shows a way to partially achieve this objective. Although the idea is interesting and the method is pertinent, it was not developed as far as it could have been, so the results are not too satisfactory. I shall propose here some improvement, enlarging the possibilities of dissociation, with the same information as point of departure.

I shall obviate the developments that can be found on page 93 and page 94 of the Technical Evaluation. The result is the dissociation of the following terms (adopting the notation as was done before).

$$\begin{aligned} &\text{i)}\ \Delta L\ \vec{O}\,[M] \\ &\text{ii)}\ L\,\Delta\vec{O}\,[M] + \Delta L\,\Delta\vec{O}\,[M] + L\,\Delta\vec{O}\,[\Delta M] + \Delta L\,\Delta\vec{O}\,[\Delta M] \qquad (12) \\ &\text{iii)}\ L\ \vec{O}\,[\Delta M] + \Delta L\ \vec{O}\,[\Delta M] \end{aligned}$$

The first term in each row is evidently the "pure" change term.

As before, (ii) plus (iii) are called the impact of manpower requirements. Now (iii) is presented as the impact of educational change per occupation, and (ii) as a residual.

Apart from the observations made in the last section, that separation between (i) on the one hand and (ii) plus (iii) on the other leaves inside these latter all the interaction elements, with L that should be differently distributed, there are now some new problems:

- Term (iii) is not exactly the impact of educational change: it also includes total interaction with ΔL, and excludes the part that should belong to $[\Delta M]$ in the interaction terms grouped in (ii).

- The residual (ii) including at the same time the pure occupational change term and three interaction terms has no great significance, since there is no way of knowing which is the part belonging to each of them.

Although the lack of $[M]$ obviously cannot be surpassed, a better result can be obtained from the data vailable.

The information at our disposal is:

$$\vec{E},\ \vec{E}+\Delta\vec{E}\ ;\ L,\ L+\Delta L;\ \vec{O},\ \vec{O}+\Delta\vec{O};\ [M]+[\Delta M] \qquad (13)$$

So we can derive by difference:

$$\Delta\vec{E},\ \Delta L,\ \Delta\vec{O} \qquad (14)$$

Although $[M]$ cannot be obtained separately we also know from (3) that

$$\vec{E} = L\ \vec{O}\,[M]$$

thus $$L^{-1}\vec{E} = \vec{O}\,[M] \qquad (15)$$

With the information mentioned in (13) and (14) the following dissociation can be proposed:

$$\Delta L\ \vec{O}\,([M] + [\Delta M]) = \Delta L\ \vec{O}\,[M] + \Delta L\ \vec{O}\,[\Delta M] \qquad (16)$$

$$L\,\Delta\vec{O}\,([M] + [\Delta M]) = L\Delta\vec{O}\,[M] + L\,\Delta\vec{O}\,[\Delta M] \qquad (17)$$

$$\Delta L\Delta\vec{O}\,([M] + [\Delta M]) = \Delta L\Delta\vec{O}\,[M] + \Delta L\Delta\vec{O}\,[\Delta M] \qquad (18)$$

The first members present all known factors.

As we also know $\vec{O}\,[M]$, then $\Delta L\ \vec{O}\,[M]$ is known and the expression (16) can be dissociated in

$$\Delta L\ \vec{O}\,[M], \quad \text{and} \qquad (19)$$

$$\Delta L\ \vec{O}\,[\Delta M] \qquad (20)$$

Furthermore we know the total $\Delta\vec{E}$, and by difference between it and the expressions (16), (17) and (18), we get the missing term from the equation (8).

$$L\ \vec{O}\,[\Delta M]$$

We finally arrive at the following dissociation of $\Delta\vec{E}$:

i) $\Delta L\ \vec{O}\,[M]$ from (19)

ii) $L\Delta\vec{O}\,[M] + L\Delta\vec{O}\,[\Delta M]$ from (17)

iii) $L\ \vec{O}\,[\Delta M]$ from (21)

iv) $\Delta L\ \vec{O}\,[\Delta M]$ from (20)

v) $\Delta L\Delta\vec{O}\,[M] + \Delta L\Delta\vec{O}\,[\Delta M]$ from (18)

There is an advantage of this formulation as compared with the one presented in the Technical Evaluation. The pure terms of variation are almost completely dissociated in (i), (ii) and (iii), except for the change in the occupational structure, including also its interaction with $[\Delta M]$. As another though less important imperfection, interaction between L and $\vec{O}$ in (v) appears added to the triple interaction term. However, with only one additional assumption about the importance of $L\,\Delta\vec{O}\,[\Delta M]$ almost the entire analysis can be carried out. If it is realised that many countries are in a position to supply this kind of information, the processing of it in the manner suggested above could bring out some very valuable information on the relative importance of the changes in the occupational and educational structure in the past years.

4. EXAMPLES OF APPLICATION

4.1. Application in Japan

The equation (5) will be used with Japanese data for 1950 and 1960. The Japanese case was selected because it provided acceptable census information for both years. As has been pointed out, it is not easy to find any time series on [M].

Factor L: The basic changing variable chosen was employed population of 15 years old and older and it is to be found in the total figure of tables 1 and 2 and in table 3. The reason for this choice is the availability of information for the two other factors.

Factor 0: Both the 1950 and 1960 Censuses were based on the ISCO classification and largely disaggregated. These groups were condensed into more aggregate groups for the following reasons:

i) As an example of application, such multiplicity of occupational classes would be time-consuming and not necessarily better a priori.

ii) At that level of detail, there were many differences in the occupational groups presented in the Censuses of 1950 and 1960. These differences disappear in the process of aggregation.

iii) The groups finally seletted corresponded approximately to those that were to be used in the Census Study of the OECD, in order to carry out the numerical work of both studies jointly and hence in a more efficient manner.

In the left hand column of tables 1, 2 and 4, each of the final groups are presented, indicating the 1960 groups they include and the corresponding Japanese code.[1]

The absolute numbers for each occupation are in the last column (totals) in tables 1 and 2, and the percentage form of $\vec{O}$, $\vec{O} + \Delta \vec{O}$; and $\Delta \vec{O}$ are presented in table 4.

Factor M: Table 5 reproduces the absolute figures of tables 1 and 2 in the percentage form of the matrix considered. Table 5 presents superimposed matrices [M], [M] + [ΔM], and [Δ M] in order to facilitate calculations, and says at the head of each column to which matrix it belongs.

The occupational classification has already been commented on. More trouble was met when dealing with the educational one. The educational classification in both Censuses is totally different. 1950's classes are defined by years of school completed (0, 1-3, 4, 5-6, 7-8, 9, 10, 11, 12, 13, 14-15, 16, 17 and +) deducting repeating years, and with no specifications whatever of the type of education followed.

The classes appearing in 1960, under the heading of the "type of the highest school completed" were the following:

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[1] Several problems were met, which are commented upon in a special note by Mr. J. Van de Vijvere for the "Census Study" conducted in OECD.

a) Elementary School
b) Higher Elementary School (old)
c) Junior High School
d) Youth Training School (old)
e) Middle School (old)
f) Senior High School
g) Higher School (old) and Junior College
h) University and post graduate course
i) Persons attending school
j) Persons having never attended school

Several attempts were made, with the information at hand, to transform this last classification into groupings of levels by years of education. The other way round was even more difficult, having different types of education and successive educational reforms (1900, 1919, 1941 and the recent one in the 1950's) for which to account. Some inconsistencies even in the definitions of 1960 were apparent (for instance, the non-existence in the whole labour force of people with incomplete primary education).

The calculations were explained in full details in the paper already mentioned. No single assumption was satisfactory enough, and in order to carry out the exercise, only the implicit interpretation of the official unit was used.[1] It can certainly be disputed but it provided a reasonable basis on which to proceed.

The classes were then grouped in the following way:

	1950	1960
0-6	0 1-3 4 5-6	a + j
7-9	7-8 9	b + c
10-12	10 11 12	e + f
13-15	13-15	g
16 and +	16 17 and +	h

Results

The results of the exercise are presented in table 6. As a consequence of misinterpretations of 1960's Census, the drop in absolute figures for the level 13-15 years of education is most probably inaccurate. Safe conclusions cannot be arrived at until some time-consuming conversion of 1960's classification is done. In order to overcome it provisionally, we have added up alternatively categories 10-12 plus 13-15 or 13-15 plus 16+ to check if there was any significant change in the interpretation when these different aggregations were used. Also in order to avoid cancellation of percentages with different signs, the participation of each factor is presented as a percentage of $\vec{E}$ rather than of $\Delta \vec{E}$ at the bottom of the table.

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[1] "Education in Japan, 1960", Ministry of Education, Tokyo.

The conclusions are the following:

i) Ignoring classification problems, results show an acceptable precision in the context of this method. Except for level 13-15, pure terms of variation cover more than 70% of the total change in each level. If class 13-15 is aggregated alternatively to both contiguous levels, we have between 80 and 90% of total change in pure terms. This means that an alternative hypothesis on the distribution of interaction factors would not significantly affect the results. In the face of this evidence, and since this was only an example, it was not considered worth doing the rather long calculation of each interaction term.

ii) As might have expected, the influence of L is the same in each level. The rather high increase of employed population during this decade (more than 2% per year) makes this factor quite an important one in the explanation of $\Delta \vec{E}$ - for some levels even the dominating one, for other levels the opposite sign is more important. This confirms the need for a careful consideration of the allocation of interaction with L, as stated in 3.4.

iii) The change in the occupational structure turned out to be a secondary factor in this case, but with increasong importance for higher levels of education. As depicted in table 6, for level 0-6 it exerts a moderate negative influence and for all other levels it has a positive influence, growing from 1.85% in level 7-9 to 19.71% in level 16 and +. This means that there is a decrease in occupations that require low level of education (thus accounting for the diminishment of about one million persons of that level), and vice versa. It means also that the higher the level of education the more important occupation at change becomes as an explanatory factor.

iv) The effect of the education associated with each occupation is more difficult to ascertain, because all the defects in the interpretation of the Census are manifest here. However, it shows up as the most important single factor (in general, about five times the influence of $\vec{O}$). It also begins with a strong negative influence for level 0-6, and increases up to + 100% for level 16 and +. The discontinuity for level 13-15 is hardly believable. If level 10-15 is aggregated, the percentage influence of [M] grows uniformly. But it should be noticed that if 16 and + is aggregated the influence of [M] turns to be negative owing to the prevalence of the negative figure for level 13-15. It can be tentatively concluded that somewhere around the higher levels of education the influence of [M] becomes very mild, if not negative.

These results partly confirm some of the tentative conclusions also of the Technical Evaluation: [M] is more important than $\vec{O}$ in the whole labour force, and it is precisely here that the information is doubtful. However results are not exactly the same as cited in the Spanish case: $\vec{O}$ increases its influence with the level of education and perhaps overtakes $\lceil M \rceil$ for some of the higher ones. A more precise comparison with the Spanish case would require some transformation of its results because they are not calculated on a strictly comparative basis with Japan. Besides the level of disaggregation of $\vec{O}$ and $\vec{E}$ are much more detailed in Japan, and Spain is a case study of projection, while Japan is a past trend. These facts suggest that further analysis would not yield better results. As will be seen, the Italian case shows very different results. This certainly emphasizes the need for a more general trial on different countries before anything conclusive can be said.

4.2. Application to Italy

On the basis of the equations proposed in section 3.4., the Italian figures shown in the main document were reconsidered. The basic data are presented in Table 7 and Table 8 and the results in Table 9.

Again, they appear to be of good precision as seen in the percentage of the total variation originated in pure terms - the fact that interaction between $\vec{O}$ and $\lceil M \rceil$ is mixed with the pure variation of $\vec{O}$, characteristic of this situation of inadequate information, is not likely to affect too strongly the rather high percentage of pure variation.

The most interesting aspect of these results is the notable difference in respect to Japanese figures with regard to the comparative influence of $\vec{O}$ and $\lceil M \rceil$. In the Italian case, $\vec{O}$ is by far the most important factor, and [M] is secondary.

Their influence according to the level of education is also different from the Japanese case: the peak of $\vec{O}$'s positive influence is in junior secondary, and decreases for higher levels of education. The behaviour of $\lceil M \rceil$ is quite similar.

It is remarkable that $\lceil M \rceil$'s influence should be negative for higher education. It means that there is a relative decrease in the proportion of university graduates on the total labour force in each occupation (on the whole).

Table 1. JAPAN 1950: LABOUR FORCE

OCCUPATIONS								
CODE ISCO	CODE JAPAN 1950	0-6			7-9			
0		68 346			215 366			535
0-0+0-X			4 348			31 520		
0-01+0-02.02/22+0-45	2+3			1 140			5 710	
0-02.24/36+0-X9.20	6			920			7 830	
0-02.38/52+ "	5			430			3 408	
0-02.60/64+ "	4			106			724	
0-02.66/48+74/82+ "	1			196			1 118	
0-02.84/99+0-X-10-03	11+13+14			1 556			12 730	
0-1+0-2			1 646			17 112		
0-1+0-22	37			172			1 821	
0-21	21			54			243	
0-23	7+10			1 420			15 048	
0-3			483			2 541		
0-31	19			280			1 086	
0-32	20			203			1 455	
0-4	24/26		4 706			54 762		
0-5	22/72+27/29		22 023			37 568		
0-6			2 102			19 060		
0-61	17			63			251	
0-69	16+18			2 039			18 809	
0-7	43		18 010			23 385		
0-8	41		309			1 693		
0-9	30/34+36+40		11 338			17 929		
0-Y	38+42+44/45		3 381			9 796		
1	46/47+51/53	49 425			160 698			176
2	III	106 904			1 033 549			1 365
3	IV	761 405			1 364 226			685
4	V	6 683 573			7 517 160			2 151
5	VI	131 796			225 704			40
6	VII+12+15+ 48/50+54	81 049			348 591			87
7/8	VIII	2 091 424			4 536 580			1 005
9	IX+35+39	384 001			742 699			299
X	X	7 537			12 001			5
TOTAL		10 365 460			16 156 574			6 352

BY OCCUPATIONS AND EDUCATION

LEVEL OF EDUCATION

10-12			13-15			16+			TOTAL		
316			504 003			199 379			1 522 410		
	77 861			66 170			23 009			202 908	
		23 046			19 764			5 426			55 086
		15 939			12 356			3 882			40 927
		9 649			11 946			5 109			30 542
		2 800			4 888			2 878			11 396
		1 949			2 126			1 307			6 696
		24 478			15 090			4 407			58 261
	37 675			21 416			6 500			84 349	
		6 061			6 544			4 158			18 756
		2 701			4 240			628			7 866
		28 913			10 632			1 714			57 727
	5 952			33 662			59 621			102 259	
		3 029			18 128			53 025			75 548
		2 923			15 534			6 596			26 711
	63 554			8 752			446			132 220	
	34 405			27 827			5 684			127 507	
	243 519			293 910			68 982			627 573	
		1 271			5 849			18 286			25 720
		242 248			288 061			50 696			601 853
	28 233			22 495			13 847			105 970	
	2 185			2 529			5 900			12 616	
	20 190			14 705			9 225			73 387	
	21 742			12 537			6 165			53 621	
635			119 827			86 787			593 372		
939			384 941			122 461			3 013 794		
357			128 594			29 622			2 969 204		
327			335 671			18 808			16 706 539		
246			8 897			1 021			407 664		
090			21 296			3 616			541 642		
586			178 875			22 618			7 835 082		
759			45 323			6 031			1 477 813		
726			1 521			537			27 322		
981			1 728 948			490 880			35 094 843		

Table 2. JAPAN 1960: LABOU

OCCUPATIONS									
CODE ISCO			CODE JAPAN 1960	0-6 a+j			7-9 b+c		
0				37 600			234 400		
	0-0+0-X				-			9 000	
		0-01+0-02.02/22+0-X9	6		-				3 600
		0-02.24/36+0-X9.20	4		-				1 900
		0-02.38/58+ "	3		-				1 700
		0-02.60/64+ "	5		-				700
		0-02.66/68+74/82+ "	1+2		-			-	
		0-02.84/99+0.X-10-03	8		-				1 100
	0-1+0-2				-			6 300	
		0-1+0-2	29		-			-	
		0-21	22		-			-	
		0-23	7		-			6 300	
	0-3				-			-	
		0-31	15		-			-	
		0-32	16		-			-	
	0-4		18/20		2 200			83 800	
	0-5		17+21+23		13 500			56 800	
	0-6				1 500			11 100	
		0-61	13		-			-	
		0-69	9/12+14			1 500			11 100
		0-7	33			11 900			23 700
		0-8	30+31		-			-	
		0-9	24/28			4 600			18 800
		0-Y	32+34/5+37			3 900			24 900
1			38/40+43	49 900			254 900		
2			III	53 800			905 200		
3			IV	587 200			2 111 900		
4			V	3 838 900			8 020 800		
5			VI	63 700			246 000		
6			VII+41+42	58 000			883 500		
7/8			VIII	1 543 600			8 124 000		
9			IX+36	315 300			1 687 000		
X			X	2 100			5 300		
TOTAL (employed labour force 15 years old and +)				6 550 100			22 473 000		

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R FORCE BY OCCUPATIONS AND EDUCATION

LEVEL OF EDUCATION			
10-12 e+f	13-15 g	16+ h	TOTAL
703 600	571 000	544 900	2 091 500
94 100	56 900	89 300	249 300
44 900	20 100	23 500	92 100
18 000	11 600	14 400	45 900
17 200	13 200	24 800	56 900
3 300	3 900	9 800	17 700
5 500	2 600	7 200	15 300
5 200	5 500	9 600	21 400
49 200	21 100	20 000	96 600
11 400	7 400	13 500	32 300
2 000	5 400	2 200	9 600
35 800	8 300	4 300	54 700
1 200	45 500	81 000	127 700
-	25 900	70 100	96 000
1 200	19 600	10 900	31 700
119 300	25 300	500	231 100
51 800	40 800	14 500	177 400
214 700	317 400	241 100	785 800
600	7 100	34 100	41 800
214 100	310 300	207 000	744 000
37 500	15 000	24 900	113 000
6 200	1 800	12 800	20 800
44 700	17 200	39 300	124 600
84 900	30 000	21 500	165 200
372 100	144 500	175 200	996 600
2 778 000	297 800	471 200	4 506 000
1 609 300	121 900	152 400	4 582 700
2 235 100	53 500	17 700	14 166 000
52 800	2 800	1 800	367 100
461 200	23 100	13 100	1 438 900
2 471 900	130 700	100 600	12 370 800
757 500	43 000	33 900	2 836 700
3 400	400	-	11 200
11 444 900	1 388 700	1 510 800	43 367 500

Table 3. JAPAN: EDUCATIONAL STRUCTURE OF THE LABOUR FORCE 1950 AND 1960

	1950		1960		1950
	$\vec{E}$	%	$E + \Delta\vec{E}$	%	$\Delta\vec{E}$
0 - 6	10,365,460	29.53	6,550,100	15.11	- 3,815,360
7 - 9	16,156,574	46.04	22,473,000	51.12	+ 6,316,426
10 - 12	6,352,981	18.10	11,444,900	26.39	+ 5,091,919
13 - 15	1,728,948	4.93	1,388,700	3.20	- 340,248
16 +	490,880	1.40	1,510,800	3.48	+ 1,019,920
TOTAL	35,094,843 (L)	100.00	43,367,500 ($L + \Delta L$)	100.00	+ 8,272,657 (ΔL)

Table 4. JAPAN: OCCUPATIONAL STRUCTURE, 1950 AND 1960

	(1950)	(1960)	(DIFFERENCE)
OCCUPATIONS	$\vec{O}$	$\vec{O} + \Delta\vec{O}$	$\Delta\vec{O}$
0			
0-0+0-X			
0-01+0-02.02/22+0+9	.16	.21	+ .05
0-02.24/36+0-X9.20	.12	.11	- .01
0-02.38/58+0-X9.20	.09	.13	+ .04
0-02.60/64+0-X9.20	.03	.04	+ .01
0-07.66/68+74/82	.02	.03	+ .01
0-02.84/99+0-X+0-03	.17	.05	- .12
0-1+0-2			
0-1+0-22	.05	.07	+ .02
0-21	.02	.02	-
0-23	.16	.13	- .03
0-3			
0-31	.22	.22	-
0-32	.08	.07	- .01
0-4	.38	.53	+ .15
0-5	.36	.41	+ .05
0-6			
0-61	.07	.10	+ .03
0-69	1.72	1.71	- .01
0-7	.30	.26	- .04
0-8	.03	.05	+ .02
0-9	.21	.29	+ .08
0-Y	.15	.38	+ .23
1	1.69	2.30	+ .61
2	8.59	10.39	+ 1.80
3	8.46	10.57	+ 2.11
4	47.60	32.66	- 14.94
5	1.16	.85	- .31
6	1.54	3.32	+ 1.78
7/8	22.33	28.53	+ 6.20
9	4.21	6.54	+ 2.33
X	.08	.03	- .05
TOTAL	100.00	100.00	-

Table 5. JAPAN: EDUCATIONAL STRUCTURE

	LEVEL							
OCCUPATION	0-6			7-9			10-12	
	1950	1960	Δ1950	1950	1960	Δ1950	1950	1960
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
0	2.14	1.80	- .34	15.54	11.21	- 4.33	38.37	33.6
0-0+0-X								
0-01+0-02.02/22+0-X9	2.07	-	- 2.07	10.36	3.91	- 6.45	41.84	48.7
0-02.24/36+0-X9.20	2.25	-	- 2.25	19.13	4.14	- 14.99	38.90	39.2
0-02.38/58+0-X9.20	1.41	-	- 1.41	11.16	2.99	- 8.17	31.59	30.2
0-02.60/04+0-X9.20	.93	-	- .93	6.35	3.95	- 2.40	24.57	18.6
0-02.66/28+74/82	2.93	-	- 2.93	16.69	-	- 16.69	29.11	35.9
0-02.84/99+0X+0/03	2.67	-	- 2.67	21.85	5.14	- 16.71	42.02	24.3
0-1+0-2								
0-1+0-22	.92	-	- .92	9.71	-	- 9.71	32.31	35.2
0-21	.69	-	- .69	3.09	-	- 3.09	34.34	20.8
0-23	2.46	-	- 2.46	26.07	11.52	- 14.55	50.08	65.4
0-3								
0-31	.37	-	- .37	1.44	-	- 1.44	4.01	-
0-32	.76	-	- .76	5.45	-	- 5.45	10.94	3.7
0-4	3.56	.95	- 2.61	41.42	36.26	- 5.16	48.07	51.6
0-5	17.27	7.61	- 9.66	29.46	32.02	+ 2.56	26.98	29.2
0-6								
0-61	.24	-	- .24	.98	-	- .98	4.94	1.4
0-69	.34	.20	- .14	3.13	1.49	- 1.64	40.25	28.7
0-7	16.99	10.53	- 6.46	22.07	20.97	- 1.10	26.64	33.1
0-8	2.45	-	- 2.45	13.42	-	- 13.42	17.32	29.8
0-9	15.45	3.69	- 11.76	24.43	15.09	- 9.34	27.51	35.8
0-Y	6.30	2.36	- 3.94	18.27	15.07	- 3.20	40.55	51.3
1	8.33	5.00	- 3.33	27.08	25.58	- 1.50	29.77	37.3
2	3.55	1.19	- 2.36	34.30	20.09	- 14.21	45.32	61.6
3	25.64	12.81	- 12.83	45.95	46.08	+ .13	23.08	35.1
4	40.01	27.10	- 12.91	44.99	56.62	+ 11.63	12.88	15.7
5	32.33	17.35	- 14.98	55.37	67.01	+ 11.64	9.87	14.3
6	14.96	4.03	- 10.93	64.36	61.40	- 2.96	16.08	32.0
7/8	26.69	12.48	- 14.21	57.90	65.67	+ 7.77	12.84	19.9
9	25.98	11.11	- 14.87	50.26	59.47	+ 9.21	20.28	26.7
X	27.59	18.75	- 8.84	43.92	47.32	+ 3.40	20.96	30.3
TOTAL	29.53	15.11	- 14.42	46.04	51.82	+ 5.78	18.10	26.3
$\sum_{o}^{x}$	285.14	135.16		708.61	601.79		763.09	857.1
Z_{o-o}^{o-x}	89.06	25.34		284.48	152.55		572.01	582.7

BY OCCUPATION 1950 - 1960

F EDUCATION (IN PERCENTAGE)

	13-15			16+			TOTAL		
Δ1950	1950	1960	Δ1950	1950	1960	Δ1950	1950	1960	Δ1950
(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
- 4.73	32.61	27.30	- 5.31	11.34	26.05	+ 14.71	100. -	100. -	-
+ 6.91	35.88	21.82	- 14.06	9.85	25.52	+ 15.67	100. -	100. -	-
+ .28	30.19	25.27	- 4.92	9.49	31.37	+ 21.88	100. -	100. -	-
- 1.36	39.11	23.20	- 15.91	16.73	43.58	+ 26.85	100. -	100. -	-
- 5.92	42.89	22.03	- 20.86	25.26	55.37	+ 30.11	100. -	100. -	-
+ 6.84	31.75	16.99	- 14.76	19.52	47.06	+ 27.54	100. -	100. -	-
- 17.72	25.90	25.70	- .20	7.56	44.86	+ 37.30	100. -	100. -	-
+ 2.98	34.89	22.91	- 11.98	22.17	41.80	+ 19.63	100. -	100. -	-
- 13.51	53.90	56.25	+ 2.35	7.98	22.92	+ 14.94	100. -	100. -	-
+ 15.37	18.42	15.17	- 3.25	2.97	7.86	+ 4.89	100. -	100. -	-
- 4.01	24.00	26.98	+ 2.98	70.18	73.02	+ 2.84	100. -	100. -	-
- 7.15	58.16	61.83	+ 3.87	24.69	34.38	+ 9.69	100. -	100. -	-
+ 3.55	6.62	10.95	+ 4.33	.33	.22	- .11	100. -	100. -	-
+ 2.22	21.83	23.00	+ 1.17	4.46	8.17	+ 3.71	100. -	100. -	-
- 3.51	22.74	16.99	- 5.75	71.10	81.58	+ 10.48	100. -	100. -	-
- 11.47	47.86	41.71	- 6.15	8.42	27.82	+ 19.40	100. -	100. -	-
- 6.55	21.23	13.27	- 7.96	13.07	22.04	+ 8.97	100. -	100. -	-
- 12.49	20.04	8.65	- 11.39	46.77	61.54	+ 14.77	100. -	100. -	-
- 8.37	20.04	13.80	- 6.24	12.57	31.54	+ 18.97	100. -	100. -	-
- 10.84	23.38	18.16	- 5.22	11.50	13.02	+ 1.52	100. -	100. -	-
- 7.57	20.19	14.50	- 5.69	14.63	17.58	+ 2.95	100. -	100. -	-
- 16.33	18.73	6.61	- 6.16	4.06	10.46	+ 6.40	100. -	100. -	-
- 12.04	4.33	2.66	- 1.67	1.00	3.33	+ 2.33	100. -	100. -	-
- 2.90	12.08	.38	- 1.63	.11	.12	+ .01	100. -	100. -	-
- 4.52	2.18	.76	- 1.42	.25	.49	+ .24	100. -	100. -	-
- 15.97	3.93	1.61	- 2.32	.67	.91	+ .24	100. -	100. -	-
- 7.14	2.28	1.06	- 1.22	.29	.81	+ .52	100. -	100. -	-
- 6.42	3.07	1.52	- 1.55	.41	1.20	+ .79	100. -	100. -	-
- 9.40	5.57	3.57	- 2.00	1.96	-	- 1.96	100. -	100. -	-
- 8.29	4.93	3.20	- 1.73	1.40	3.48	+ 2.08	100. -	100. -	-
	635.16	491.35		408.00	701.57		2800.00	2800.00	
	605.83	464.61		384.62	674.50		1400.00	1900.00	

Table 6. FACTORS OF CHANGE IMPACT ON VARIATIONS OF EDUCATIONAL LEVEL OF THE LABOUR FORCE - JAPAN 1950 - 1960

CHANGING FACTOR		L	$\vec{O}$	[M]		← (INTERACTION) →		
LEVEL OF EDUCATION (IN YEARS)	$\Delta\vec{E}$ =	$\Delta L\ \vec{O}$ [M]	$+L\ \Delta\vec{O}$ [M]	$+L\ \vec{O}$ [ΔM]	$+\Delta L\ \Delta\vec{O}$ [M]	$+\Delta L\ \vec{O}$ [ΔM]	$+L\ \Delta\vec{O}$ [ΔM]	$+\Delta L\Delta\vec{O}$[ΔM]
0 - 6	-3,815,360	+2,443,304	-1,009,647	-4,125,498			-1,123,519	
7 - 9	+6,316,435	+3,808,219	+ 299,407	+2,225,484			- 16,675	
10 - 12	+5,091,919 =	+1,497,812	+ 435,143	+2,095,304			+1,063,616	
13 - 15	- 340,248	+ 407,733	+ 178,344	- 747,152			- 179,173	
16 and +	+1,019,920	+ 115,542	+ 96,751	+ 550,753			+ 256,874	

PERCENTAGE OF DISTRIBUTION OF $\Delta\vec{E}$ IN PURE AND INTERACTION TERMS

LEVEL		$\Delta\vec{E}$		PURE TERMS		INTERACTION		
0 - 6		100.00		70.55		29.45		
7 - 9		100.00		100.26		- .26		
10 - 12		100.00		79.11		20.89		
13 - 15		100.00		47.34		52.66		
16+		100.00		74.81		25.19		
10 - 15		100.00		81.38		18.62		
13 and +		100.00		88.57		11.43		

INFLUENCE OF EACH FACTOR (ONLY PURE TERMS OF VARIATION) AS A PERCENTAGE OF E

LEVEL	$\vec{E}$	%	$\Delta\vec{E}$	L	$\vec{O}$	[M]		
0 - 6	10,365,460	100.00	- 36.81	+ 23.57	- 9.74	- 39.80		
7 - 9	16,156,565	100.00	+ 39.10	+ 23.17	+ 1.85	+ 13.92		
10 - 12	6,352,981	100.00	+ 80.15	+ 23.58	+ 6.85	+ 32.98		
13 - 15	1,728,948	100.00	- 19.68	+ 23.58	+ 10.31	- 43.21		
16 and +	490,880	100.00	+207.77	+ 23.57	+ 19.71	+112.19		
10 - 15	8,081,929	100.00	+ 58.79	+ 23.58	+ 7.59	+ 16.68		
13 and +	2,219,828	100.00	+ 30.61	+ 23.57	+ 12.39	- 8.85		

Table 7. ITALY: LABOUR FORCE BY OCCUPATION AND EDUCATIONAL LEVEL IN 1961
(in thousands)

EDUCATIONAL LEVEL OCCUPATION	PRIMARY OR LOWER	SECONDARY 1ST CYCLE	SECONDARY 2ND CYCLE	HIGHER	TOTAL
Heads and managerial staff	-	-	186.0 (29.4)	446.0 (70.6)	632.0 (100.0)
Intermediate managerial staff	-	1,461.0 (62.4)	882.0 (37.6)	-	2,343.0 (100.0)
Qualified personnel	5,146.0 (91.8)	459.0 (8.2)	-	-	5,605.0 (100.0)
Non-qualified personnel	10,820.0 (100.0)	-	-	-	10,820.0 (100.0)
TOTAL 1961	15,966.0 (82.3)	1,920.0 (9.9)	1,068.0 (5.5)	446.0 (2.3)	19,400.0 (100.0)
TOTAL 1951	14,977.0 (88.1)	1,041.0 (6.1)	650.0 (3.8)	337.0 (2.0)	17,000.0 (100.0)

Table 8. ITALY: OCCUPATIONAL STRUCTURE

OCCUPATION	1951	1961
Heads and managerial staff	2.40	3.26
Intermediate managerial staff	8.78	12.08
Qualified personnel	22.12	28.89
Non-qualified personnel	66.70	55.77
TOTAL	100.00	100.00

Table 9. ITALY: THE SOURCES OF EDUCATIONAL CHANGE: 1951-1961

Level	$\Delta\vec{E}$	=	$\Delta L\vec{O}[M]$ +	$L\,\Delta\vec{O}[M]+[\Delta M]$ +	$L\vec{O}[\Delta M]$ +	$\Delta L\vec{O}[\Delta M]$ +	$\Delta L\Delta\vec{O}[M]+[\Delta M]$
Primary or lower	+ 989		+ 2215	- 801	- 185	- 27	-113
Secondary 1st cycle	+ 879	=	+ 146	+ 444	+ 198	+ 29	+ 62
Secondary 2nd cycle	+ 418		+ 91	+ 254	+ 32	+ 5	+ 36
Higher	+ 114		+ 48	+ 103	- 45	- 7	+ 15

Percentage distribution of $\Delta\vec{E}$ in pure and interaction terms

Level	$\Delta\vec{E}$	Pure terms (Plus interaction $\vec{O}[M]$)	Other interaction
Primary or lower	100.00	114.3	- 14.3
Secondary 1st cycle	100.00	89.6	10.4
Secondary 2nd cycle	100.00	90.2	10.4
Higher	100.00	92.1	7.9

Influence of each factor (only pure terms of variation) as a percentage of E

Level	$\vec{E}$ (in thousands)	%	$\Delta\vec{E}$	L	$\vec{O}$ (plus $\vec{O}[M]$)	[M]
Primary or lower	14,977.0	100.00	+ 6.6	+ 14.1	- 5.4	- 1.2
Secondary 1st cycle	1,041.0	100.00	+ 84.4	+ 14.0	+ 42.8	+ 18.9
Secondary 2nd cycle	650.0	100.00	+ 64.3	- 14.0	+ 39.1	+ 4.9
Higher	332.0	100.00	+ 34.3	+ 14.5	+ 32.5	- 15.4

SECOND NOTE ON THE VARIATIONS OF THE EDUCATIONAL STOCK OF THE ACTIVE POPULATION

SECOND STAGE OF THE ANALYSIS OF CHANGE FACTORS[1]

I. THE SECOND STAGE

This paper tries to follow through and go a step further with the methods of analysis proposed in the first part of this work written by R. Hollister. In a previous paper on the methods of analysis proposed in The Technical Evaluation of the Mediterranean Regional Project I have made some comments on the analysis of sources of change, and applied those methods to the data for Japan 1950-1960. The objective of that exercise was to test the scope of such a method in a situation where better comparative data for two different periods in the same country existed.[2] As a consequence of the virtues and shortcomings observed, this paper proposes some possible ways of complementing that type of analysis in order to deal more effectively with additional information that might also be available. I also think it interesting to arrive at less complex factors than those used before, and to be able to deal with some theoretical issues that require an adequate framework for the discussion.

I shall call the first stage analysis the one that divided the change in the educational vector of the labour force ($\vec{E}$) into the combined effect of respective changes in the total labour force (L), the occupational structure ($\vec{O}$) and the educational distribution by occupation ([M]).[3]

The second stage will consist in trying to break down each of these variables into new subfactors and thus getting a more complete explanation of them and - subsequently - of $\vec{E}$. The methods applied to L and $\vec{O}$ are similar to that of the first stage, so the only interest there, could be the example of how the analysis of sources of change can proceed by successive approximations, and the selection of the new explaining variables. In the case of [M], the situation is much more complicated, and requires a totally different treatment. That is why the section commenting on that matrix predominates largely over the other two.

As very little methodological experience has been gathered on these problems, this study will be only tentative. It must be clearly stated that one should not conclude from this paper that the desired results can only be achieved through the methods proposed here. Certainly the value of such developments as presented for L and $\vec{O}$ for instance, will depend largely on the part of total change for which the factor to be analysed is responsible. In other words particular types of dissociation will be worth continuing depending on the results of the first phase in any research.

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[1] This note was written by Raul Trajtenberg, a fellow of the Ford Foundation Programme of OECD, in agreement with R. Hollister.

[2] In the Technical Evaluation a great emphasis is put on the limitations of the data available.

[3] The detailed explanation of terms and the development of the identities can be found in Appendix IV of the Technical Evaluation and in the Application already mentioned. They will be recalled when necessary.

II. FACTOR L: THE TOTAL LABOUR FORCE

The type of dissociation feasible in the case of L will depend on what kind of population was used in the first stage as the basic changing variable. If, as has been proposed, L is total employed population, one possible set of subfactors could be:

$$L = {}^{t}\vec{L}.\ {}^{a}\vec{L}.\ {}^{e}L \qquad (1)$$

being ${}^{t}\vec{L}$: (line vector) Total population by age groups.

${}^{a}\vec{L}$: (column vector) Activity rate for each age group.

${}^{e}L$: (scalar) Global rate of employment for active population.

This is a well covered field, and there is no need to insist too much on the importance of separating these three factors, each of them being under the influence of very different variables and subject to varying degrees of political influence. When the labour force is dealt with as a scalar number, there is a great temptation to consider it purely as a supply factor. This was done in the Technical Evaluation, where the procedure began by separating L from $\vec{O}$ and $[M]$.* When the three subfactors are distinguished then their differing natures can be assessed, and furthermore, regroupments of factors of change for theoretical reasons - for example identification of supply and demand - can include only part of L.

The division accepted is not the only possible one. $\vec{t}_L$ is obviously the product of a scalar by a percentage structure vector. Furthermore, if the rates of employment for the active population are available for each age group, the second factor should be presented as a diagonal matrix, and the third one would be a column vector.

If the presentation in (1) is, for example, accepted, the identity to be used in order to obtain the respective weight of each of the three factors in the total change of L is:

$$\begin{aligned}\Delta L = {} & \Delta{}^{t}\vec{L}.\ {}^{a}\vec{L}.\ {}^{e}L + {}^{t}\vec{L}.\ \Delta{}^{a}\vec{L}.\ {}^{e}L + {}^{t}\vec{L}.\ {}^{a}\vec{L}.\ \Delta{}^{e}L \\ & + \Delta{}^{t}\vec{L}.\ \Delta{}^{a}\vec{L}.\ {}^{e}L + \Delta{}^{t}\vec{L}.\ {}^{a}\vec{L}.\ \Delta{}^{e}L + {}^{t}\vec{L}.\ \Delta{}^{a}\vec{L}.\ \Delta{}^{e}L \\ & + \Delta{}^{t}\vec{L}\ \Delta{}^{a}\vec{L}\ \Delta{}^{e}L \qquad (2)\end{aligned}$$

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* Tech. Eval., para. 128-129.

(1) This identity is arrived at in the first paper. Briefly:

$$L = {}^{t}\vec{L}\ {}^{a}\vec{L}\ {}^{e}L \qquad (3)$$

and $$L + \Delta L = ({}^{t}\vec{L} + \Delta{}^{t}\vec{L})\ ({}^{a}\vec{L} + \Delta{}^{a}\vec{L})\ ({}^{e}L + \Delta{}^{e}L) \qquad (4)$$

Subtracting (3) from (4), we get:

$$\Delta L = ({}^{t}\vec{L} + \Delta{}^{t}\vec{L})\ ({}^{a}\vec{L} + \Delta{}^{a}\vec{L})\ ({}^{e}L + \Delta{}^{e}L) - {}^{t}\vec{L}\ {}^{a}\vec{L}.\ {}^{e}L \qquad (5)$$

Developing (5), identity (2) is obtained.

As explained also in my first paper, for similar identities, the first line groups the three terms of pure variation; the second, those of interaction between pairs of two elements and in the third line, there is the triple interaction term. I will refrain then from any comment on (2), since it is an identity of the same nature as that used in the first stage, the only difference being that now it is applied to one of the factors of change.

III. FACTOR $\vec{O}$: THE OCCUPATIONAL STRUCTURE OF THE LABOUR FORCE

Factor $\vec{O}$ is more complex and the practical value of its analysis for manpower planning is greater. Several variables of interest, implicitly combined, produce $\vec{O}$. In order to evaluate them, they must be made apparent in some way.

There are many ways to deal with it, but perhaps the most useful would be to use the elements already put forward by Parnes and made explicit in the Technical Evaluation.[1] In that case we would be dissociating the influence of $\vec{O}$ into the respective influence of two principal subfactors:

- the economic structure
- the occupational structure in each economic sector.

There is a positive advantage in bringing up separately these two factors. Some occupations are strictly associated with certain economic sectors (e.g. farmers). Others, even if they can appear in most of the sectors, tend to concentrate in only a few. If there is any significant change in the structure of the economic sectors, and if the relative importance of the sectors associated with particular occupations varies, there will be a change in the total occupational structure. This is a well known fact but it will not be possible to quantify it, unless factor $\vec{O}$ is dissociated.

There is an immediate way of doing it:

$$\vec{O} = \vec{U}\ [V] \tag{6}$$

where

$\vec{U}$: (row vector) Percentage distribution of labour force by sector of economic activity

$[V]$: (matrix) Percentage distribution by occupation of the labour force in each economic sector.

However the suggestion of taking occupational co-efficients (related to output figures) instead of percentages is worth taking into account: independent changes in one occupation will effect its own percentage and all the others, while at the same time, they would modify only its own co-efficient. In that case a previous change of the basic changing variable from labour force into output should be made. The identity would then turn into:

$$\vec{O} = P.\vec{S}.\ [T] \tag{7}$$

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[1] See Techn. Eval. para. 103-121.

being

P : (a scalar) Average productivity in the whole economy (GNP:L)

$\vec{S}$: (row vector) Percentage distribution of GNP by economic sector.

$[T]$: (matrix) Occupational co-efficients by economic sector.

Every element in the matrix is then: L_{ij}/GNP_j (i standing for occupations and j for economic sector). Rows represent different industries and columns represent different occupations. The horizontal addition of each row will equal L_j/GNP_j. That is: the inverse of the average productivity by economic sector.

P is the factor changing the basic variable - obviously L.P = G.N.P. So the part of the variation (positive or negative) finally assigned to it will indicate the correction on $\vec{O}$ of basing it on the variable output instead of on population.

$\vec{S}$ introduces explicitly the economic structure (in percentage output figures). After deducting the weight of this element, judgment of the importance of change in occupations can be based on variations originating in the shift of occupational co-efficients. These are included in the third factor $[T]$. It should be recalled that $[T]$'s quota in the change of $\vec{E}$ is not necessarily lower than $\vec{O}$'s. It might well happen that changes within $\vec{S}$ and $[T]$ would show that the restructure of occupations has a more significant place in total change of $\vec{E}$ than was thought at the end of the first stage.

Factor $[T]$ brings in as has already been mentioned, the occupational distribution by sector in the form of technical co-efficients. It is an extension of the concept of labour productivity (here inverse). It has the same disadvantage as long as it measures only the relation between output and one factor, but not the contribution of this factor to output. However, some refinement is made since each occupation is measured separately (as analogous to a factor of production).

Following the same algebraic method as in (2), we arrive at another identity that will allow us to compute the respective weight of each of the three factors in the variation of $\vec{O}$:

$$\Delta\vec{O} = \Delta P\,\vec{S}\,[T] + P\Delta\vec{S}\,[T] + P\vec{S}\,[\Delta T] + \Delta P\Delta\vec{S}\,[T] + \Delta P\,\vec{S}\,[\Delta T] + P\Delta\vec{S}\,[\Delta T] + \Delta P\Delta\vec{S}\,[\Delta T] \qquad (8)$$

IV. FACTOR [M]

1. Presentation

Of the three factors whose influence was dissociated in the first stage, the matrix relating occupational and educational categories in the labour force appeared to be by far the most important one. The kind of analysis made up in preceding paragraphs, however, does not allow one to determine the real relation between occupations and education as it appears numerically in [M] nor how, and under which forces it changes from one situation to another. The relation between these two variables is not a very well explored field and is generally considered one of the weakest parts in manpower planning. Some effort towards clarifying its intricacies and searching for appropriate measures would probably be rewarding.

Since in the analysis of ⌈M⌉ the method of dissociating factors through the development of identities has not proved fruitful, it seems more interesting to concentrate on the problem of association between the two variables.

This chapter will contain a detailed description of matrix ⌈M⌉ , some comments on the meaning and ways of measuring the association between the two variables involved, and an attempt to put together the set of different factors that may affect such a statistical relationship.

2. Description of ⌈M⌉

Let us remember the structure of ⌈M⌉ ; vertically appear the different occupations in the labour force and horizontally a distribution (in percentage form) of the labour force in each occupation by level and/or type of education.

The following matrix ⌈M⌉ corresponding to Japanese data for 1960 is presented as an example summarized in aggregate categories.[1] ⌈M⌉ is enclosed by double-line.

TABLE 1

YEARS OF EDUCATION / OCCUPATIONS ISCO	0-6	7-9	10-12	13-15	16 and +	TOTAL
0	1.80	11.21	33.64	27.30	26.05	100.00
1	5.00	25.58	37.34	14.50	17.58	100.00
2	1.19	20.09	61.65	6.61	10.46	100.00
3	12.81	46.08	35.12	2.66	3.33	100.00
4	27.10	56.62	15.78	.38	.12	100.00
5	17.35	67.01	14.39	.76	.49	100.00
6	4.03	61.40	32.05	1.61	.91	100.00
7/8	12.48	65.67	19.98	1.06	.81	100.00
9	11.11	59.47	26.70	1.52	1.20	100.00
X	18.75	47.32	30.36	3.57	-	100.00
TOTAL	15.11	51.82	26.39	3.20	3.48	100.00

The two-dimensonial distribution in consideration has certain characteristics that make it especially difficult to handle. The vertical variable (occupations) has no underlying continuity and does not present any natural order. The first aspect seems clear enough. The problem of ordering occupations could be subject to more discussion; I will deal with it afterwards. Let me say for the moment that as long as we are dealing with the relation between education incorporated in each occupation and the role of these occupations in the production process, any criterion for ordering occupations should be based on the last link. That is, it should be derived from some hierarchy of the occupations in the economic system. Even if some partial order can be found among groups of occupations in a particular industry, there is no satisfying overall order in the economy.

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[1] See Annex to Technical Evaluation.

The educational variable has neither underlying continuity nor natural order if the whole of the possible specifications are considered even though some groups of classes may be ordered (for example a succession of levels of the same type of education), there are break-ups of continuity and of order whenever different types of education are taken into consideration. However, it is important to remember the possibility of treating it as an ordered variable as long as the different types of education are not considered; in what follows, education will be treated as an ordered succession of levels.

There is another aspect to take into consideration when we are dealing with such an ambiguous problem as that of the association between occupation and educational level in the labour force; which of the two is to be considered the causal variable and which the consequence ? In view of the implicit logic of the current approach the occupation is considered as the cause and the education as the consequence. This means that the function each occupation exercises in the production process determines, in the way of a technological co-efficient, the educational input needed or desirable for that occupation. This is not the only way to look at this relationship, but it should be kept in mind that any reversal causal - or chronological - link would have a very different conceptual implication. Besides, the presentation of the two dimensioned distribution in a horizontal percentage form, already indicates which is the causal link to be considered.

Having thus defined the variables connected by [M], this matrix could be thought of as a series of horizontal distributions of different educational levels by occupation. The characteristics of each of these distributions, their mutual relationship, as well as the variety of factors that produce them, is our concern.

3. Study of association in [M]

A. Importance

I list below some of the reasons why I think a study of association in the two-variables distribution [M] would be of use.

i) In general a more precise indication of the degree of statistical relationship between occupations and education would be obtained. The analysis of production function formulations relating quantities of education to the occupation in the economic system is not yet well developed. A study of their degree and type of association would certainly be a useful basis for some provisional conclusions about the link between the two. If possible, a synthetic way of expressing the association in [M] should be devised in order to make comparative studies easier.

ii) The conclusions of the first stage could be revised in the light of what is found from [M]. As will be seen later, a part of the dispersion inside this matrix could be explained by shortcomings or plain defects in the occupational classification, the result of which would have been to assign initially to [M] some of the variations that should belong to $\vec{O}$.

iii) Some valuable information concerning substitution possibilities. At first it might seem that a perfect association case - considering such the situation where there is only one filled up box in every row in the matrix - would indicate the complete absence of substitution, a rigid technological co-efficient relating both variables. As association decreases, occupations begin to be filled up by people with uneven educational background, indicating a greater amount of flexibility in substitution possibilities. In the extreme situation of independence - all conditional educational distributions (per occupation) being identical - the analysis of occupations would become useless for purposes of planning educated manpower.

But substitution possibilities, even keeping apart for the moment every statistical practical problem, should not be so easily identified with association in [M]. The case of complete association could be also explained by a different set of hypotheses; complete rank correlation among the educational level, the productivity, and the average salary by occupation, plus a perfectly competitive labour market. In this situation, even if substitution were technically possible, the complete association would result from the operation of the market. Furthermore some administrative (e.g. hiring) methods or sociological (e.g. prestige) reasons could theoretically replace productivity and salaries as the mechanism producing a certain order of educated people through occupations that would result in a complete association. Thus, the underlying technological substitutability would be again disguised.

The inverse is also true: the lack of associations does not guarantee the existence of substitution possibilities. This point will be further developed in a coming section.

Although these alternative interpretations require a more refined analysis in order to draw any conclusion about substitution possibilities, the information from [M] is a fairly important starting point, especially if a set of matrixes [M] are available for different times and countries.

Two more general problems could be also dealt with while considering matrix [M]; the identification of supply and demand effects in the educational co-efficients, and the even more basic one of evaluating the whole manpower approach to educational planning. These two aspects, plus the one treated in the preceding paragraph, are sometimes considered one and the same thing in discussions; this does not help to get a clearer view. Although the logical order of presentation should have been different, we have begun with substitution to make the exposition easier.

iv) The controversy over the most valid approach to educational planning can be illustrated when referred to matrix [M]. The manpower requirements approach - and all approaches that deal with the problem of supply - demand consideration at the point where outflow from the educational system meets the demand for workers. These approaches are based on one essentially simple idea; the educational level of the worker is a basic element in determining his skill and that educational level either makes production possible, or makes it more economic. In the first case a strict correspondance would be found between the functions performed and the level of education. In the second case, employers would be willing to pay different salaries to workers according to their level of education, and workers would seek employment at the highest salary possible. In both types of situation one can speak of a market supply and demand facing each other. Both situations which have already been mentioned when commenting on substitution possibilities, would tend in principle to produce a close association between occupational and educational categories.

On the other hand and taking things to the extreme - if the effects of education on economic efficiency are presumed non-existent, the labour market problem regarding education disappears entirely since no differential in wages is conceivable. The whole problem of educational planning is shifted to the inflow side of the educational system; the demand for places in the educational system originates in totally different factors. Whatever the occupation, the employers are indifferent to the level of education of the worker. There being no differential in salaries, there is no way of channelling certain levels of education to specific occupations. As a result, the educational distribution within each occupation tends to be the same. As will be remembered, this is the situation of perfect independence in matrix [M].

Briefly, the degree of association in matrix [M] would tend to indicate the relative need for, and adequacy of the manpower requirements type of approach. A similar idea is held by Folger and Nam.[1] It can be recalled that the Technical Evaluation of the MRP that comprised only a first stage type of analysis could not go any further than calling attention to the possibility that part of the variation attributed to [M] could be owed to factors different than power requirements.

v) The problem of identification of supply and demand effects in the change of [M] is now more easily placed.

All change in the educational level of the labour force brought up by the type of factors grouped under the leading of "cultural" are to be considered a supply - originated variation - since demand has no effect on them. It must be stressed that these changes do not originate independently of any economic consequence, but also that they have no repercussion on production.

For all other changes in the educational level of workers by occupation, the identification of supply and demand is investigated the same as in any other similar problem, and is very much related to the substitution problem.

In this respect, two levels should be considered: first the determination of the educational co-efficient by occupation; and second, the size of each occupational group.

In the no substitution case, the coefficients are directly fixed by a given technology, so that the number of educated people available can have no influence on them. It is clearly a demand dominating situation at the level of the determination of co-efficients. This does not mean that demand dominates all over; the amount of people in each occupation is decided by the interplay of supply and demand as usual in those situations. In a first approximation the employment level could be thought of as fixed - at the level where the bottleneck group would be fully employed - all other groups showing some degree of unemployment. Demand would still be dominating. However, supply could influence the labour market through salary adjustments or other factors, and there being no possibility of changing the factors' co-efficients, the adjustment could show up in a restructure of the output in order to minimize redundancy. In this second level, then, the respective influence of supply and demand could be approximated further by an analysis of the level and evolution of salaries and especially, unemployment.

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[1] See J.F. Folger and Ch. B. Nam, "Trends in Education in relation to Occupational Structure", in Sociology of Education, Vol. 38, 1964.

In the case of substitution between educational categories, the availability and wages of different educational categories of workers will also influence the size of the co-efficients. To find out exactly how the equilibrium is achieved, a great amount of information is needed on the technological internal of substitution, and on the evolution and determination process of salaries.

vi) Another more detailed point of interest would be related to the type of projections to be made concerning the educational level in each occupation. Currently there is some discussion about the convenience of introducing a matrix of transfers from previously forecast optimal allocation situation to the expected one taking into account all the forces that shift the distribution of workers out of the purely technologically based estimates.[1]

If manpower projections are not to be turned into a somewhat academic exercise their objective should not be to work on the basis of suitably educated stock, but on the number of workers that under the pressure of all foreseen policy measure and all other socio-economic variables, will not be affected by policy action, and will be available as an effective supply. This means that one must take into consideration on the one hand, a certain matrix of transfers that is already at work - in order not to extrapolate blindly present misallocation - and on the other hand, the transfers to be predicted all through the planning period in order not to create a future disequilibrium situation.

The determination and qualification of the various components which shape the transfer matrix is a very delicate problem and will not be fully answered before other questions such as those referring to optimal allocation, positive and negative mobility, etc., are solved. But the study of [M] could be a first effort in that direction. The measure of association in it and the causes of non association are very much (although only partly, as will be seen below) related to transfers among occupations.

As planning cannot wait for final theoretical answers, the kind of spreading through education that will be found in [M] - adequately interpreted and corrected - could be used in the conversion of projections of occupationally distributed manpower into educated stock.

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[1] Bernard Grais: "Techniques de prévision de population active par profession et niveau de qualification", OCDE, 1965; and H.S. Parnes: "Forecasting educational needs for Economic and Social Development", OCDE, 1962.

B. The search for a synthetic measures

Although a study of association in [M] seems rewarding because of its theoretical implications the problems to be faced in order to achieve it are quite important. In fact this section should be the result of a statistician's research but unfortunately experts have not gone very far toward solving this kind of problem. Here, I will try to define with some precision a field were methodological research should be carried on, and develop what can be considered of interest for immediate application. At this moment, when as a result of large scale data collection in the OECD there begins to become available some sets of tables that could be presented in the [M] form, empirical research should be conducted with the best measures available, even if they are far from being perfect. To discuss them briefly is my intention.

There are many reasons - and later on I shall deal with them - to react to the difficulties of achieving a global measure of association. That is, one that supplies the probability that people working in certain occupations should have a certain educational background. The way out would be either to devise a graphical presentation or to deal separately with each occupation. But graphical studies will not go farther than analytical ones, and particular analysis, when there is no clear way of relating the different findings in each occupation, are no substitute for some measure synthetic enough to give in one number a summary of information relative to a whole market - all occupational and educational classes comprised. As a first approach to a fairly complex set of information, this would be the more practical method because it would allow for very general primary conclusions taking into account the maximum of data available at the same time. On the convenience of complementing with particular studies, I shall comment again in a next section.

We must remember what was said while making a description of [M] (Section 2): while searching for a measure of association we came across three big problems; (a) is there any order in the educational variable; that is, is there any underlying principle that will allow us to order in a uniform way all the educational classes we have from the statistical tables ? (b) a similar question concerning occupational categories; (c) is the link between occupations and education to be considered symmetric or asymmetric, and in the last case, which of the two is to be taken as the causal variable ?

In order to deal with them I shall consider three cases considered significant:

i) the most complex case, taking both occupation and education as politomies without natural order or underlying continuity;
ii) accepting - and conforming [M] in a corresponding way - that the educational classes could be presented in an hierarchic order;
iii) adding to the last assumption some way of ordering occupations. The symmetry problem will be considered at the same time.

a) The unordered case

Most known statistical measures deal with ordered variables, which makes this a very difficult case to handle. Except for the mode, most measures of central tendency and of dispersion are unapplicable to the unordered case and so are measures of association based on them.

Furthermore, the greatest interest of an analysis of association in [M] is the possibility of comparing different matrices over period time or among different countries. In that case all measures based on chi-square must be dropped on account of their numerical uncomparability, as advised by Goodman and Kruskal.[1]

These two authors consider among others a type of measure that could well fall under these specifications; the λ (lambda) measure based on a probability model of prediction. It is of a certain interest - its properties are discussed more extensively in the reference made - because there is a comparison possible between two different matrices and their respective degree of association, and because the measure does not change by permutation of rows or columns.

Reproducing the table with notations used in this article.

TABLE 2

	B_1	B_2		B_b	Total
A_1	p_{11}	p_{12}		p_{1b}	$p_{1.}$
A_2	p_{21}	p_{22}		p_{2b}	$p_{2.}$
A_a	p_{a1}	p_{a2}		p_{ab}	$p_{a.}$
Total	$p_{\cdot 1}$	$p_{\cdot 2}$		$p_{\cdot b}$	1

Calling:

p_{ab} = proportion of the population classified as both Aa and Bb

$p_{\cdot b} = \sum_{b} p_{ab}$ = marginal horizontal frequencies

$p_{a.} = \sum_{a} p_{ab}$ = marginal vertical frequencies

$p_{mb} = \underset{a}{\text{Max}}\ p_{ab}$ = maximum frequency in column b

$p_{am} = \underset{b}{\text{Max}}\ p_{ab}$ = maximum frequency in row a

$p_{\cdot m} = \underset{b}{\text{Max}}\ p_{b}$ = maximum marginal horizontal frequency

$p_{m.} = \underset{a}{\text{Max}}\ p_{a}$ = maximum marginal vertical frequency

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[1] See Leo A. Goodman and William H. Kruskal "Measures of Association for cross-classifications", in the *Journal of the American Statistical Association*, December, 1954, pp. 732-763.

The measured proposed - its development to be found in the reference - is:

$$\lambda a = \frac{\sum_b p_{mb} - p_{m.}}{1 - p_{m.}} \tag{6}$$

if education is taken as the causal variable, and

$$\lambda b = \frac{\sum_a p_{am} - p_{\cdot m}}{1 - p_{\cdot m}} \tag{7}$$

if the asymmetry is taken from occupation to education. It means the decrease in the probability of error in determining the education of an individual from a situation where the occupation held by him is not known to the one where the occupation is previously known.

This results from the following (always choosing lambda b as the example): in situation 1, ignoring the occupation of any one person, the determination of his educational background will be done on the basis of the whole educational distribution for the population, i.e. the row of vertical totals in Table 2. The maximum frequency in that row ($p_{\cdot m}$) will be selected, and the error of doing so will be $1 - p_{\cdot m}$.

In situation 2, the occupation is known to be a certain occupation *a*. Then in the corresponding row, $p_{a.m.}$ will be chosen, and the error will be $1 - p_{a.m.}$ If this is generalized for the whole population, the error will be:

$$\sum_a (p_{a.} - p_{am}) = 1 - \sum_a p_{am} \tag{8}$$

The measure lambda, defined as a percentual decrease in error from a situation type 1 to one type 2 is then:[1]

$$\lambda b = \frac{(\text{probab. situation 1}) - (\text{probab. situation 2})}{(\text{probab. situation 1})} = \frac{\sum_a p_{am} - p_{\cdot m}}{1 - p_{\cdot m}} \tag{9}$$

Some variations on these formulæ can be made considering the possibility of conveniently weighting rows or columns.

An example of the application of this measure will be shown in the Appendix. It was decided that the most convenient form was as follows:

1. *Lambda* b rather than *lambda* a (always considering occupation as the vertical variable and education the horizontal one). *Lambda b* is preferable because it measures horizontal conditional probabilities where the condition is some occupation and the maximal frequency considered is a level of education; thus the technological relationship going from occupations to education we are considering, is respected.

2. With respect to the weighting problem in measuring *lambda b* there are five alternatives:

a) no weighting (respecting original horizontal and vertical totals);

b) equalising horizontal totals;

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[1] This development is similar to the one presented in op. cit. p. 14, footnote (1).

c) equalising vertical totals;
d) giving other weights to horizontal totals;
e) giving other weights to vertical totals.

The measure according to (a) is the one that better represents the real association in the whole market. If there are some occupations that largely predominate, their association with the educational alternatives will heavily effect that of the whole labour force. Thus the association for the whole will take into account conditional probabilities of different occupations, weighting them according to the importance of the respective occupation.

But if the purpose is to compare spatially or temporally two matrices, then the different weight of each occupation should be eliminated so as to deduce from the variation of the association measure the effect of a changing occupational structure - which has been taken into account already with the factor $\vec{O}$ in the source analyses.

Corrections (c), (d) and (e) do not apply to the kind of study we are now considering.

We may remember that the presentation of [M] that has been in consideration is already in the form (b).

Problem of partition and aggregation in the matrix will also exert an influence on the result. Examples of these and the precedent - alternatives are to be found in the Appendix.

3. Shortcomings of a *lambda* type of measure.

Taking into consideration *lambda's* definition and the numerical exercise put forward in the Appendix it cannot be considered that too much progress is made by it's use. However, rather than its own defects, it is the restriction set up in the beginning that makes it difficult to handle.

Association, as measured by *lambda* is very much influenced by two things; the conditional relative modal frequencies (pam), and the relative disposition - vertically speaking of those different modes.[1] Although the mode is a measure of central tendency, its relative frequency can be taken as an indirect way of measuring dispersion. As such it would be useful to measure association. But it is a very imperfect one; it does not take into account the actual dispersion, nor any irregularity (plurimodal), a symmetric distribution, kurtosis, etc.) that might appear. As will be seen, the very nature of factors that influence these distributions makes it likely that different and changing patterns in the distributions will appear.

The other factor strongly influencing the result is the vertical relative disposition of the different conditional modes - indicating in their turn the extent of superposition of conditional distributions. This is also an interesting element in measuring association, but as we are not to expect regular distributions, it is again not sufficient.

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[1] This results from the definition of *lambda:* the relative frequencies of conditional modes are important because they add up in the numerator ($\sum_a P_{am}$). The more each row is concentrated in the modal figure $\sum_a P_{am}$ will tend to one, and *lambda b* would tend to 1 (perfect association). On the other hand, vertical disposition of conditional modes also has an effect; in an extreme case if all were to coincide in the same column, then $\sum_a P_{am} = P_{am}$, and the numerator of *lambda b* would be 0 (and so would *lambda b*).

b) Education as an ordered variable

The possibilities of measuring this relationship would certainly improve if we introduced some concept ordering one or both variables.

Let us begin by considering the educational variable. This gets us back to one of the problems already mentioned: is education really an ordered variable or not ? The situation is very uncommon, and there is not any single answer. If all problems of translation to one equivalent time of study are previously solved (this problem will be referred to in a coming section) there is certainly an underlying order to be considered between all educational classes. This information has been wasted above in 3 B (a) while considering educational classes as unordered attributes. However, it is certainly significant in the association problem; and it does not mean the same that horizontal frequencies should be distributed between two contiguous classes or that they would appear disposed in classes far from each other in the time of study scale.

But the problem is not only of conversion: it is to be expected that different types of education would require the same time period. So the order could not be made among all educational classes, but among groups of them inside which there would be no order.

This poses peculiar problems to the use of traditional measures. One way out of it would be to consider each of these groups as only one class. In this case - the contrary of (a) - we would be using the information on different levels of education and we would be partly losing that referring to types of education.

Still, we would face the problem of measuring the association between one ordered variable and another that is not ordered. Some measure using the maximum of information would probably not be difficult to devise, it is well inside a statistician's field.

As we have seen that neither case (a) nor (b) are too convincing, and since they use partly different information, one obvious possibility would be to work with both of them successively.

c) Both occupation and education as ordered variables

One more possibility, worth exploring since there have been some attempts to use it, is to order occupations following some criteria to be devised - remembering what was said about the ordering of education. If it is possible, certainly the statistical problems are quickly simplified because it is a more common situation where normal procedures - as for instance rank correlation - could be applied.

It is not easy to propose any convincing ordering for occupations that would adapt to the problems under consideration. As is set out in the description of [M] in the rationale of this approach, occupations are representative of skills for certain economic activities. To this should be related any order given to them.

It might be worth mentioning the possibility of ordering them according to their average salary. Behind it there is a complex set of hypotheses on the representativeness of salary as income level; on the wage determination process; on the correlation between economic efficiency and salary rate among occupations, etc. As a consequence, we might well ask if the rank correlation between educational level and average salary by occupation that we would be in fact measuring would actually answer our questions.

In their study of the association between occupations and education in the United States, Folger and Nam[1] used a somewhat different approach. They employed a measure Γ (gamma), based on a probabilistic model taking into account the order of both variables. The sort of ordering they used for occupations was based on their social prestige following the conclusions of empirical studies made in the United States.[2] Furthermore, the symmetry taken into consideration was the inverse of ours; they used education as the causal variable and occupation as the function. As can be seen from both exercises, what they are in fact measuring is the ability of persons with different educational levels, to climb up the social ladder. It is doubtful that any conclusion on supply - demand effects could be arrived at in this way. The dangers might be foreseen in the case of a labour force allocated strictly according to technical needs of production. A social prestige order different from that of the economic needs, would be enough to have the gamma association measure decreased.

4. Factors Influencing the Educational Distribution by Occupation

A. The Problem and the Approach

We might ask ourselves at this point if we have not been considering matrix [M] in a rather simplistic way. It might prove useful to leave for the moment the attempt to get a global and synthetic measure of association, and go somewhat more deeply into all the variables that could be influencing the horizontal distributions. One point of obvious interest is to determine the degree to which these other factors can affect educational distribution in a different way for different occupations. If that is the case, global analysis of association would appear of a more restricted importance, and should be complemented by a comparative study of distributions in specific occupations.

What follows is an enumeration of different aspects - going from mere mechanical side-consequences to socio-economic and technical variables - that combine to explain the relationship. Some of the basic problems already mentioned, for example, substitution are reinserted with some more details.

The evaluation of such things as the whole approach to educational planning through projected manpower requirements, could also be attempted by considering of the factors to be mentioned which questions the premises of that approach, and which merely affects the outcome in matrix [M].

The method followed will be to start with a very simple theoretical matrix and by adding, literally one by one, the variables expected to exercise an influence, arrive at the type of matrix normally found in reality. Later on, it will be interesting to restate our original theoretical link and to examine which factors are likely to affect it basically thus inviting us to deny some of the hypotheses, and which affect only superficially the statistical exteriorization.

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[1] J.F. Folger and Ch.B. Nam, op. cit.

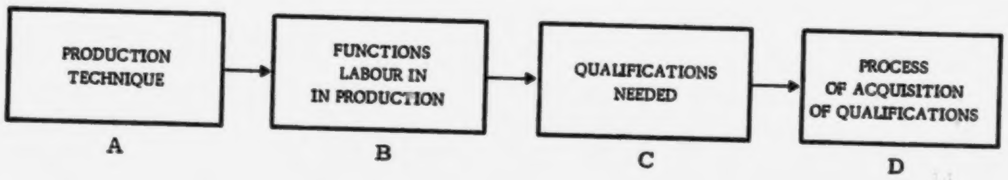
[2] This was kindly explained to us in a personal communication.

This initial matrix would result from the following considerations: putting together formal education and all forms of training - respecting the unity of each step whenever necessary - there would be as many classes of educational output differentiated as possible, including levels as well as types of education. If we accept hypothetically that education is an input in the production function we are also accepting that occupations should be related closely to the educational level of workers. Finally, if occupational groups in a classification are derived by putting together occupations according to the educational background needed to perform the economic tasks, we will arrive at a square matrix with complete association in both senses (only one cell would be filled for each row or column). Such is the situation for example, in the following matrix:

TABLE 3

EDUC. OCCUP.	1	2	3	4	5	6	7
1	x						
2			x				
3		x					
4				x			
5						x	
6					x		
7							x

This very simple rigid one-way relationship will have to be refined. Its underlying complexities could be more easily discussed by referring to a diagram where the main steps in the reasoning are made explicit.


PRODUCTION TECHNIQUE
A
FUNCTIONS LABOUR IN IN PRODUCTION
B
QUALIFICATIONS NEEDED
C
PROCESS OF ACQUISITION OF QUALIFICATIONS
D

Each production technique will be linked with education through defining the place of labour in production and the qualifications needed. I shall make a quick enumeration of the principal problems to be found in each cell of the diagram, from left to right.

B. Coexistence of Different Production Techniques

It may be accepted that techniques in production determine not only a particular mix of factors of production and a structure for them, but also the function to be performed by each particular element in the process and the quality required for it. When we pass from this rather abstract statement to the consideration of a concrete situation in a particular branch of industry, we will find an initial complication arising from the fact that normally there is coexistence of various techniques. This heterogeneity has two principal sources; first, temporal differences in the original investment data may include different incorporated techniques because of technological knowledge and/or the relative factor prices may change over a period of time;[1] second, different choices of techniques from what is called the best practice technique at each point of time. This can be due to several imperfection factors such as obstacles to the diffusion of new techniques, the unawareness of managers and labour pressures, the imperfection in the market, the amount of initial investment required, etc.

The result is that, ceteris paribus, and accepting the link occupation-education proposed at the beginning and that techniques of production determine not only proportions of each occupation but also their content in terms of knowledge and skills, some explanation for the dispersion of educational requirements for particular occupations can already be found.

C. Degree of Homogeneity in Occupations

Passing to the section B of the diagram, a careful consideration of what types of functions actually exist in production and what is their relation to the occupations usually found in classifications and national statistics will throw some light on the link A-B and especially the link B-C.

The are several problems to consider:

a) Relation between Jobs and Tasks

Some jobs cannot easily be related to one or more tasks. The degree of homogeneity of jobs in terms of functions to be performed in them is then a further complication. This might occur for instance, when very heterogeneous tasks are aggregated into one job, or when certain tasks appear only seldom and occupy a very small proportion of total working time, but are the most demanding in terms of background needed. OECD has recently brought attention to the fact that modern ways of production may be enlarging the proportion of jobs where no strict association with tasks can be found. When this kind of task heterogeneity appears, there is room for a dispersion of the educational background supposedly associated with each job.

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[1] See W.E.G. Salter "Productivity and Technical Change".

b) Homogeneity of occupations

Jobs aggregate themselves into occupations according to similar educational standards needed. However, occupational classifications are still too imperfect to allow for an adequate grouping of jobs. Furthermore, national statistics in each country add up minor occupational groups into aggregates in such a way that heterogeneity can only increase. This effect can be even worsened when the criteria for grouping has not been purely educational. In a matrix like the one suggested above in para. 3. A, the aggregation phenomenon (adding up rows) would necessarily create more dispersion in the resulting row than there was in the initial ones. This sort of dispersion could account for an important part of the distribution whose origin we are trying to explain.

D. Under and Overqualification

Cell C in the diagram deals with the qualifications needed to perform the economic functions. An increasing amount of work by job analysts is helping to define the qualifications needed in terms of mental and physical faculties; professional knowledge, responsibility, etc. Accepting for the moment that there is some strict relation between qualifications and educational background, the implicit assumption of the theoretical matrix proposed in para. 3.A would be that the latter's needs would be clearly defined.

However, this estimate results from the minimum amount of education needed in order to achieve some specified level of efficiency. There is always a possibility that persons who have more than the necessary qualifications will offer themselves and be accepted in occupations of a lower category. Scales of salaries, social prestige, excess supply, rigidity of labour market (salaries included) and awareness of employers are some of the variables that can produce this overqualification (or overeducation) phenomenon. Even if it is difficult to say abstractly what would happen to the function performed; in general, one would expect a less than proportionate improvement in efficiency (the optimum defined being left behind) and thus, a waste of education. The effect on the educational distribution by occupation would be a shift to the right in the measures of central tendency, an increase in dispersion, and some skewness to the right.

There is also the inverse case of underqualification. The determination of a minimum qualification needed does not necessarily mean that for the employee possessing less than the minimum the performance of tasks comprised in the jobs becomes impossible. It can, however, mean that it will take the employee more time and involve more risks, or that he would produce worse quantitative or qualitative results. Translating again qualification directly into educational level, we would also increase dispersion, and for the rest it would have the inverse results on the educational distribution than those mentioned in the last paragraph.

E. Alternative Ways of Acquiring Qualifications

Several problems appear in section D of the diagram. The first is concerned with the different ways of acquiring qualifications. This touches one of the weak points of educational planning and manpower statistics. Both techniques hane not yet developed enough to be used for specifying much more than the educational background alone, and sometimes referring only to formal education. However, it is recognised that qualifications for work are the result of natural aptitudes of the individual and environmental influences, formal education and training, training on the job, professional experiences, study at home and many other factors. They are partly complementary and partly substitutable. In addition some of them are quantifiable and some of them are not, and all of this poses very delicate problems.

The substitution possibilities between them will have two types of effect on the theoretical matrix considered. If the substitution is between factors included as horizontal classes (for instance between types of education, or between education and training), the result would be dispersion (each occupation being associated with more than one educational class). If the substitution is possible between some factor included in the horizontal scale and some other that is not (for example, between education or training and professional experience), the effect on the educational distribution would be a shift to the lower level classes, and probably an increased dispersion and a skewness to the left.

F. The Measure of Education

Let us concentrate for a moment on education, and forget alternative ways to qualify it. Several problems will affect its measure, introducing changes in the distributions.

If we were still interested in considering a sort of functional relationship from right to left in the diagram, we ought to have a measure of the education received sophisticated enough to allow us to consider it in some strict relation with the qualification needed. Unfortunately, such is not the case, and many years will pass before some way and data are found to measure output of education. In fact, what we do use is an indicator: time of study. Difference between educational institutions, methods, teachers, etc., apart from all the aleatory phenomena associated with the result of education, make it foreseeable that for a similar result to be obtained (for example, ability to perform certain tasks) there will be a dispersion in the time of study required.

Furthermore, time of study is not usually measured by its real length in hours of study (anyway, there would be problems of difficult solution, i.e. individual participation, home study, etc.) but by a simplifying measure: years (or fractions of years) of study.

It should also be recalled that this type of measure is quite affected by repeaters and drop-outs in the educational system. Any assumption that is introduced to convert them into the common measure will certainly introduce irregularities.

G. Cultural Professional Balance in Education

In paragraph 4.E above the problem of substitution of other means of achieving qualification for education was mentioned. There is also the reverse. Education is not only a way of obtaining the necessary abilities for production: at each level and type of the educational system people are being taught - for cultural reasons - a wide variety of subjects that will not affect, or only affect in an indirect way their economic efficiency after graduation.

This very important point makes it more difficult - but not impossible - to relate different occupations to the respective educational classes whose end products have the necessary qualifications for production.

As the theoretical matrix was already thought of in terms of a certain existing educational system - thus taking into account both types of knowledge at each level - there is no need to think of this problem as a general shift towards longer periods of study. But some effects will be felt in the distribution:

i) The different amount of general knowledge in two types of study - without significant variation in the professional one - would be a new source of substitution much the same as the one described in para. 4.E.

ii) Closely associated with the cultural part of education although not wholly explained by it - is compulsory minimum education. This is the current situation in modern societies and has shown an historic tendency towards shifting upwards the lower limit that is socially accepted. The effect of such a uniformisation of the lower part of the educational structure is the combining in one group of all those occupations which would have normally required less than the minimum amount of education. The dispersion is thus decreased, and one could expect a shift to the right of the mean and mode, and possibly a skewness to the right.

H. Specification of educational classes

This is a difficult point that has already been mentioned while describing [M] . Even from the theoretical point of view, maximum disaggregation is not necessarily optimal or possible. The consistency of the educational system must be taken into account. There would be no sense in cutting in the middle any level when no output is foressen at that point. The degree to which this introduces a further rigidity in the relation between occupation and education will depend on how much the economic needs are taken into account when the educational system is built and some other considerations to be treated under J.

The result would probably be an enormous classification, if one attempted to incorporate all training systems. Not many countries are prepared to know so much about their labour force. What is normally found - if there is any data - is an aggregation of all classes into a much smaller unit. This also has an effect on the distribution; the addition of columns in the matrix will decrease its dispersion, although some of them could be left unchanged.

I. Exceptions to the basic diagram

Before leaving these considerations, it would be useful to recall that even if the diagram of Section 4.A - with all the pertinent comments is at the very base of this association between the occupation and education approach - there are some exceptions that produce further irregularities in some of the distributions.

There is the case, for instance, when educational background is not taken as an indication of qualifications obtained, but as a social or intellectual selective mechanism. Sometimes, the university degree is more important to the employer as a prestige symbol than as an indication of professional efficiency. Clearly, in these cases the line of thought does not depart from technical considerations and the scheme is not applicable. It might be worth paying attention to this possibility for certain specific occupations where deviations from this kind of analysis are greater.

Another source of deviation, although not exactly an exception from the basic diagram would be the fact that human activity in production is normally characterized by two facts; it has a certain stability in the location of work, and it presupposes an increasing qualification as time passes. As such, labour contracts are not only decided on the basis of the qualification already possessed by the worker and the place he is going to fill immediately, but also on his potential future career in the firm. We have then a sort of superposition of two negotiations, and, as conditions affecting one decision are not the same as those that concern the other basic variables like age and sex affect them quite differently. We would find in this case that even if the conceptual link is unaffected, some disparities in the educational background for the post to be held immediately would result.

J. Dynamic problems: marginal changes and time-lagged changes

Up to now the analysis has been merely static. The passage of time seriously affects all these variables. The four elements appearing in the basic diagram will normally undergo changes over periods of time. New techniques of production appear in the market; the functions of labour may either stay unchanged, or vary gradually; new functions may appear or old ones disappear. The change will bring related variations in the qualification needed. Occupations may be restructured, some new posts being added, or some posts shifted from one occupation to another as a consequence of a change in their educational requirements. The systems of acquisition of qualifications will not only have to adapt to these new requirements (for instance, change their structure of levels and types of output) - but will also suffer certain changes of their own. The educational system, for example will undergo some technical changes in the methods of teaching, in their output structure and in the balance between cultural and professional courses, etc. Consequently, changes in the relation between time of study and qualifications acquired may also occur.

All this would not be worth worrying about, if it were not for two further conditions; first, changes are always marginal in the principal variables; and second, changes are normally lagged among these variables. These two conditions may have a predominant share in the explanation of heterogeneities and disequilibrium shown in any cut in time of the type of [M].

The first of these conditions was partly referred to when considering the selection of any specific techniques (section 4.B). The educational structure of the labour force undergoes a similar process. Apart from the professional experience gained through normal work, there are two principal ways of changing qualifications in the labour force; first, through the entrance of new workers; and, second, through retraining. The first of these is the main one and it is clearly marginal. Only a small percentage of the labour force can come directly from the yearly output of the educational system. Consequently, changes in the educational system will be reflected in the labour force only many years afterwards. A short-cut to account for this fact is retraining (or any type of study done after the beginning of working life), but this has had only limited scope. Besides, it presents very delicate statistical problems of translation into qualifications acquired through the first method.

The second type of phenomena is the lag between changes in different variables. Here we have the educational response to the change in economic needs delayed not only by the marginal mechanism but also by several factors of inertia in the educational system; time to be aware of productive needs, time and ability to translate them into an adequate educational programme, time and desire to make a start (rigidity of structure), problems of buildings, teacher's formations, time to form new graduates under new programmes and so on.

It is very difficult to say abstractly what would be the effect of these dynamic factors on a matrix [M] at one point of time, but it is undeniable that they would exercise a very important influence. The relative speed of change in functions and educational level and the respective relative importance of the marginal changes to the total will be useful elements in interpreting some shiftings and distortions of the educational distribution. One could probably expect at least more dispersed ones.

K. The Table No. 4 that follows, will give an idea of the influence some of the variables above mentioned can have on the distributions. The high proportion of blanks is due to the fact that in several cases it is not possible to say in advance, in a general form, what will be the direction of the shift or change in the distribution. Only empirical studies of concrete cases would answer this kind of question. Of course, the filled spaces should not taken as more than a priori an example, to be worked on empirically.

5. Conclusions

The mere stating of a set of variables, most of them very difficult to measure and some of them with hardly any data at all, must appear very confusing to any practical minded person wanting to make the quickest possible decisions for planning purposes. However, if any progress is to be achieved in a new field such as this one, it will ne through a healthy equilibrium between theoretical developments and empirical research and planning. Perhaps there is no perfect measure to work with while dealing with [M] still, it is important to know the shortcomings of those which will be eventually used, and to dissociate the errors coming of the method chosen from those belonging to the sources of information, and from those originating in the hypothesis handled.

Furthermore, it is possible that quite a few of the factors introduced to explain part of dissociation in [M] will not be manageable in statistical terms in a short period. But it is important to know the risk to be run when only a little part of it is chosen to be used as

TABLE 4

	SHIFT OF MEASURES OF CENTRAL TENDENCY				DISPERSION		SKEWNESS TO THE	
	MEAN TO THE		MODE TO THE					
	LEFT	RIGHT	LEFT	RIGHT	DEC-REASED	INC-REASED	LEFT	RIGHT
4.B Coexistence of productive techniques					-	x		
4.C a) Relation between jobs and tasks					-	x		
b) Homogeneity of occupations					-	x		
4.D Overqualification	-	x	-	x	-	x	-	x
Underqualification	x	-	x	-	-	x	x	-
4.E Alternative ways of acquiring qualifications								
Substitution between factors included					-	x	(x)	-
" " " " and not	x	-						
4.F The measure of education								
4.G Cultural professional balance in education, as a source of substitution possibilities (compulsory minimum education)	-	x	-	x	x	-	-	x
4.H Delimitations of educational classes					x	-		
4.I Exception to the basic scheme					(x)	-		
4.J Dynamic problems					-	x		

explanatory variables. Besides, among all the possible empirical research that such a vast and unknown field opens, a better selection of priorities can be made once the whole set of variables is at hand.

Even at this stage, some primary conclusions could be drawn, as a way to accentuate the main points in this paper and to suggest some empirical work possible and needed to follow this line of thought.

i) The method by which labour force by occupation is normally converted in an educational vector, symbolised by matrix [M] is misleading in its apparent simplicity. The analysis made in the first-stage, by merely separating the pure and interaction effect of [M] on the change of E does not go far enough.

ii) Even the results of the first stage are liable to revision according to what happened inside matrix [M]. For example one of the principal conclusions of the application of L.$\vec{O}$. [M] analysis to some countries was that [M] had generally a much more pronounced effect than $\vec{O}$ on the change of $\vec{E}$. But the problem of aggregation of occupational categories - already studied as a factor of dispersion in [M] - could well have a misleading effect. Consider the case when the relation between two occupations associated with different educational levels, but aggregated into one category - dispersion generating case in [M] - changes, without a change in their respective levels of education. The apparent effect - shown by a first stage type of analysis - would be a shift due to factor [M]. In fact this kind of change would have been attributed to $\vec{O}$, if the classification system had been better.

In the same example, the results of a second stage analysis of $\vec{O}$ would have also changed, and instead of leaving immobile all three subfactors [T] should have suffered the variation wrongly attributed to [M].

Some other examples of aspects of [M] affecting the results of a first stage analysis could be thought of, but of course many - probably most - aspects of [M] would leave them unchanged.

iii) Some important points of discussion could be illuminated by a study of [M]. Such is the case for the convenient degree of aggregation, the scope of substitution possible, the identification of supply and demand and in general the way to approach educational planning. Some light will be shed on them by the mere global kind of comparative study among matrices [M]. A deeper consideration of specific conditional distributions will be in certain cases more useful or will complement our knowledge of the behaviour of the two variables under consideration. As a result, some more detailed aspects of human resources planning, such as the more effective way to translate an occupational vector into an educational one, and the convenience of using transfer matrices, might be somewhat more clarified.

iv) Even at this theoretical stage it is possible to see more clearly how dangerous is the use of too linear and simple relationships between occupations and education, and how misleading or insufficient some types of categorisation can be for planning purposes. One could well ask what do occupations account for in the context of the factors mentioned in Section 4, and if there is not a dilemma between somewhat arbitrary grouping, stable enough to be manageable for intersectoral, international or intertemporal comparisons, and a permanently adjusted classification that would be of little statistical use. A great deal of factual knowledge is needed before anything definite can be said.

Some advantages exist from the conceptual point of view, in passing through the occupational categories. This should be true for most sectors of economic activity where the link between education and occupation can be spread in steps similar to those in the diagram No. 1. Some studies have been tried relating the output of sectors of economic activity directly to the educational level of the labour force. Referring to diagram 1, it can be seen that what in fact is done is to group into only one category all the different functions in box B belonging to the same economic sector and by dropping all other information concerning boxes A, B and C, to link it directly to box D. As usual in similar statistical problems, the decision to pay attention or disregard information available must be taken in the light of the particular balance of virtues and defects in the information. It is possible that in some economic sectors, certain biases in the occupational classification tend to increase up to a point where they may add more errors than useful information. For instance, where for technological or organisational reasons posts tend to group heterogeneous and/or shifting tasks, as mentioned in 4.C. In this case, occupational categories would disturb rather than help the analysis. Better results might be expected linking output directly to educational level.

At the present stage of knowledge, it can be then said that in general, occupational classifications should be used as much as possible, and efforts should be directed towards refining their measure, rather than dropping them, although in some cases a mixed procedure - considering also the association, output - education - would be recommendable, or even only the last one advisable.

v) The enumeration of factors in Section IV 4. calls attention to the need of specifying with more precision the conceptual link chosen as basic for the whole approach. If we consider it to be between occupations and formal education, then all those factors are relevant. But we could chose jobs instead of occupations, eliminating 4.C. (b) or even tasks, thus eliminating 4.C. (a). On the other side, instead of formal education we could refer to the part of it interesting from the professional point of view, doing away with 4.G, or considering minimum education (4.D) or taking into account all means of acquiring qualifications (4.E). The more we specify the concepts in use, the fewer sources of errors are left to affect their relationship (and also the more generality we lose).

It could be also interesting to recall that some of the factors mentioned in IV 4. do not affect the conceptual link initially set between occupation and education - whatever the exact concept chosen - but the statistical exteriorisation of its relationship. This is the case for instance of coexistence of productive techniques, or measure and aggregation problem in education, or some of the dynamic problems.

vi) It would be too ambitious to determine here exactly what kind of statistical or econometric studies would be advisable in order to take maximum advantage of information appearing in a matrix [M]. The type of information available would certainly be the main obstacle and the study should be programmed correspondingly. Some information already collected recently in the OECD census study provides a good point of departure for it. There are some first obvious steps in such an analysis: comparative studies in global association; application of some basic statistical measures of central tendency, dispersion and skewness to conditional distribution; a comparative study of these changing either the occupation in the same matrix, or the country for the same occupation. If more data becomes available for comparative periods of time or different economic sectors, the scope of the study could certainly be enlarged. Furthermore, data on trends and structure of salaries and unemployment would become necessary at a certain point, and so would information on physical capital and investment. But the scope research should be made in more concrete terms taking into account the information available.

Studies of the age structure by occupation would lead to interesting results on dynamic problems, and they would be all the more useful given the lack of historical trends.

In general, a multivariate analysis should be tried with all the possible quantifiable variables mentioned also introducing some obviously important characteristics of the labour force (age, sex, etc.). The analysis that has been made should have separated, for instance, the problem of women as distinct from men workers. No doubt some of the factors in IV.4. have a quite different influence on both sexes. Methods such as multiple regression analysis could help to make these apparent.

APPENDIX

As an example, some applications of measure lambda are shown. Japan's case is chosen, since it allows for comparison between 1950 and 1960 in an approximate way.

Tables 5 and 6 present the basic data for Japan in both years and Tables 7 and 8 show the corresponding percentage form of [M] 50 and [M] 60.[1]

As explained in the text, only the following case will be presented:

i) two politomies: A (occupation)
B (educational level)

ii) no continuity

iii) no natural order

iv) asymmetry holds: A classification precedes the B one.

$$\lambda_b = \frac{\sum_a p_{am} - p._m}{1 - p._m} = \frac{\sum_a v_{am} - v._m}{v - v_m} \qquad (10)$$

Where λ_b, p_{am} and $p._m$ are the symbols already explained in section IV 3.B (a) and v substitutes p indicating absolute frequencies instead of relative ones (in order to make the calculations for the no weighting case).

(1) Without weighting

$$\lambda_b^{50} = \frac{16{,}960{,}585 - 16{,}156{,}574}{35{,}094{,}843 - 16{,}156{,}574} = .043$$

$$\lambda_b^{60} = \frac{25{,}153{,}600 - 22{,}473{,}000}{43{,}367{,}500 - 22{,}473{,}000} = .128$$

(2) Weighting rows

The weights are chosen to equalize horizontal marginal frequencies. Then it comes to the same thing as applying the measure to a table disposed as [M] where all horizontal marginal frequences are equal to 100.

$$\lambda_b^{50} = \frac{1279.56 - 763.09}{2800.00 - 763.09} = .254$$

$$\lambda_b^{60} = \frac{1468.68 - 857.13}{2800.00 - 857.13} = .315$$

The following two cases are equivalent to the former, but applying the measure only to the occupational categories beginning by digit 0 (professional workers).

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[1] The source is again the application of the methodology to Japan already mentioned.

[2] See page 170.

(3) Without weighting

$$\lambda_b^{50} = \frac{655,827 - 535,316}{1522,410 - 535,316} = .122$$

$$\lambda_b^{60} = \frac{959,100 - 703,600}{2091,500 - 703,600} = .184$$

(4) Weighting row (Same considerations as in case 2)

$$\lambda_b^{50} = \frac{851.72 - 605.83}{1900.00 - 605.83} = .182$$

$$\lambda_b^{60} = \frac{963.30 - 674.57}{1900.00 - 674.57} = .236$$

Although the application of lambda to only one country, and with only two points of reference in time does not allow for many conclusions on the numbers themselves or on the method, some remarks can be made on the results.

i) There is in general a very weak association - as measured by lambda - in the case of Japan between the two variables.

ii) The association has risen significantly from 1950 to 1960.

iii) The method of weighting equally each occupation greatly improves association. This means that there is an inverse relationship between the relative importance of some occupations in the total, and their internal association with any educational class. The validity of this consideration has been decreasing along time increases 6 times from case 1 to case 2, while λ does it only 2.5 times.

iv) Cases 3 and 4, chosen as an example of particular application of the same measure on some sector of [M] indicates how much the pattern of association can change. Occupations under group 0 can be said to be more closely associated with education in both years than the whole of the labour force. The increase during the 1950's in their association is less significant than the one experienced in the total labour force: .5 times in the former; 3 times in the latter. Weighting of rows does not improve association of 0 groups and education as much as for the labour force as a whole.

More conclusive remarks could be put forward if a complete study on the variations of conditional distributions as proposed in IV.5 were made showing how conditional modes change their relative frequency and shift horizontally, and what happens to conditional dispersions. But this is quite a long exercise and the results would justify the work only when a sufficiently large number of cases is at hand, and calculations could be programmed in a computer.

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PRINTED IN FRANCE